APPLIED HYDRAULICS

NOVEMBER 1954

THE MAGAZINE OF
FLUID POWER
INCLUDING AIR CONTROLS
AND AIR CIRCUIT DESIGNS
• ELECTRICAL CONTROLS •

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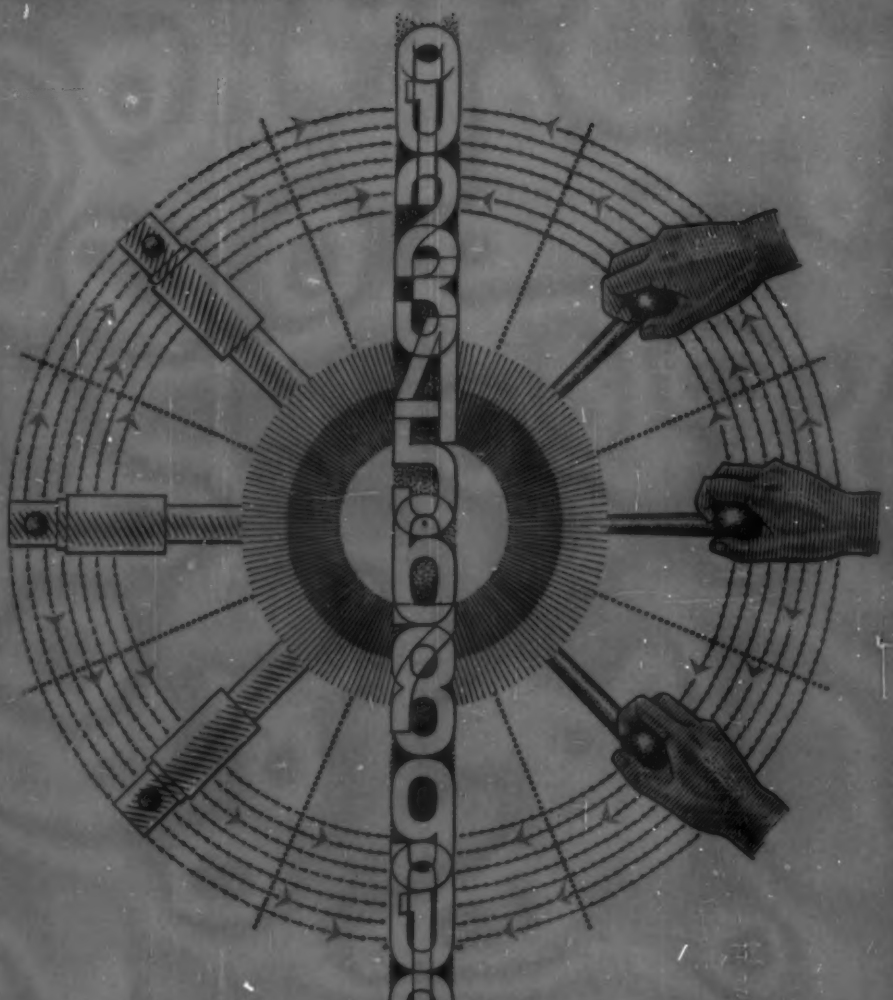

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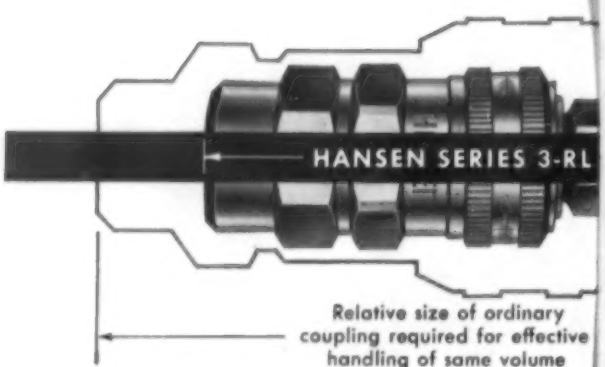
Here it is—

THE NEW HANSEN SERIES 3-RL

QUICK-CONNECTIVE RING-LOCK COUPLI



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Coupling will handle any job in your shop using
connections—from the air line to the air tool. N
is there any need for various sizes of couplings at
points in your hook-up. The Hansen Series 3-R
completely interchangeable sockets and plugs
all—makes it easy to keep stock of parts in balance
inventories to a minimum.

Carefully designed, the Hansen Series 3-RL combines maximum flow with compact construction. Sockets are brass with steel sleeves—plugs are steel. Sockets for use with small hand-operated air tools are available in aluminum.

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Ring Lock Provides Practically 360 Metal to Metal Contact

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Hanna Air Cylinders raise and lower the entire conditioning ring-pressure plate units to permit fast, efficient loading and unloading of parts on this Lapmaster. In many cases, production has been doubled over manual operation.

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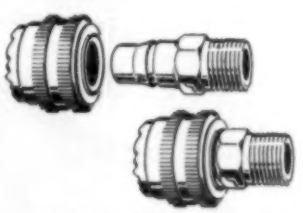

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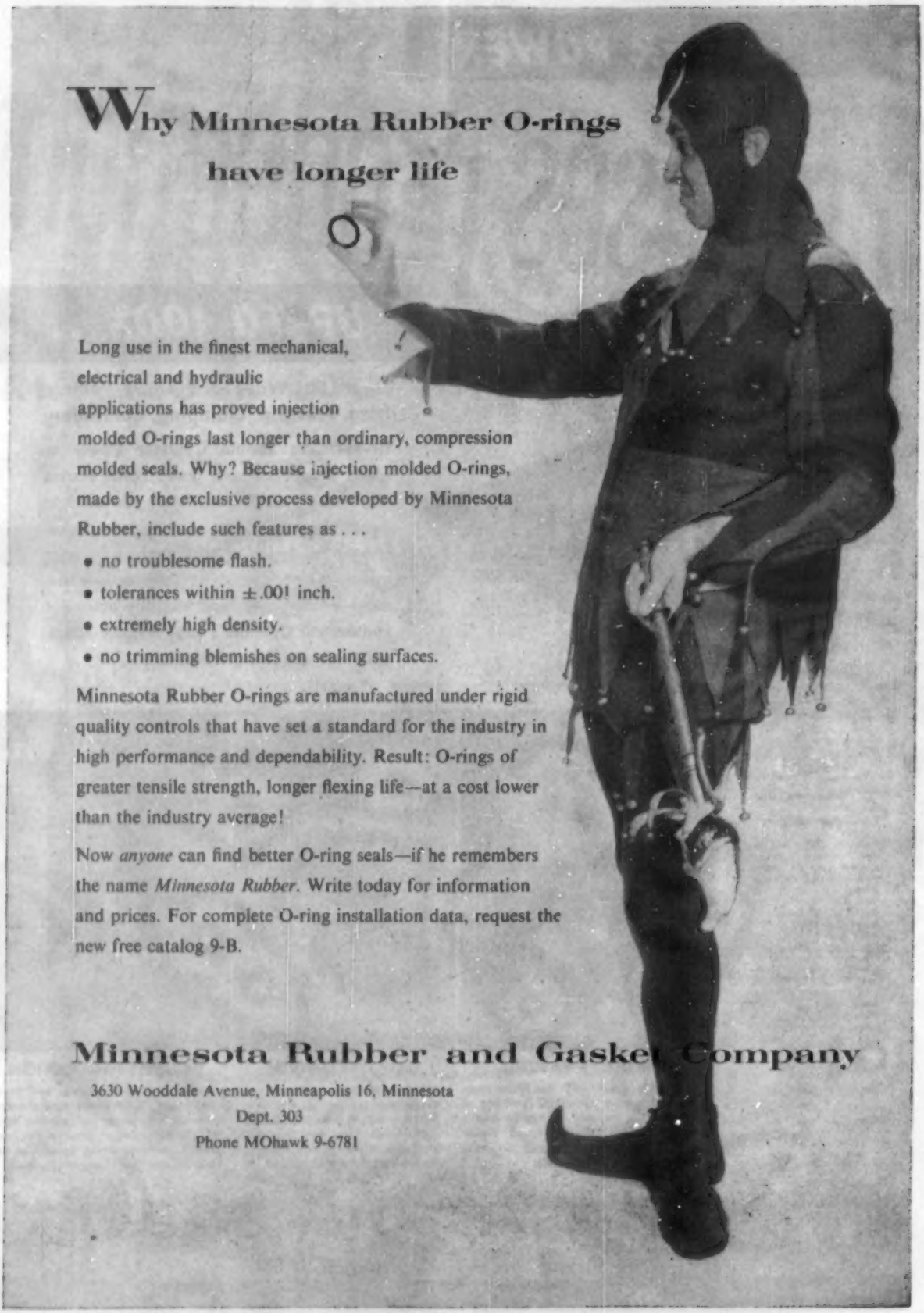
Why Minnesota Rubber O-rings have longer life



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APPLIED HYDRAULICS

VOLUME 7 NUMBER 11

NOVEMBER 1954

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BPA

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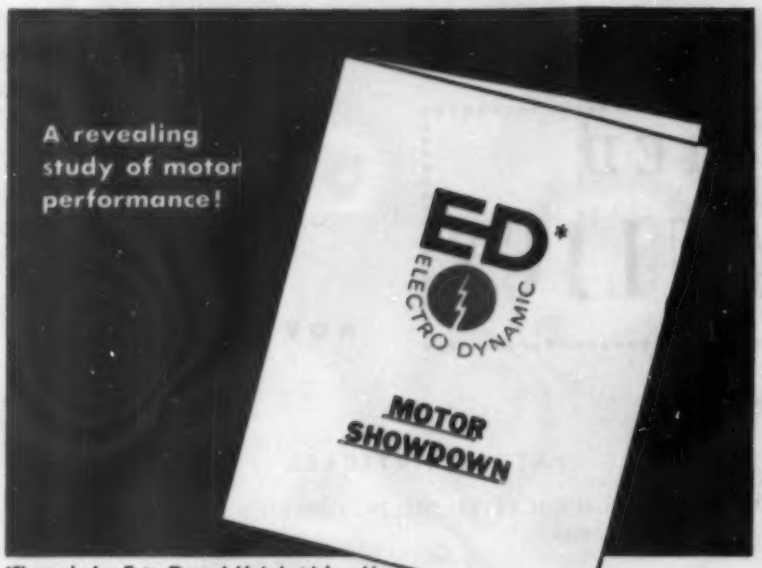

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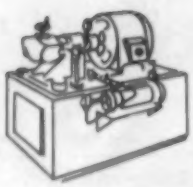

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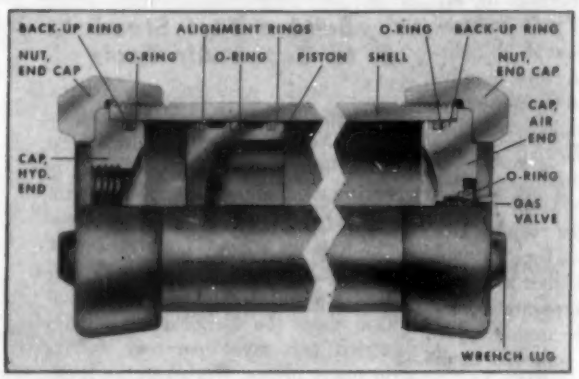
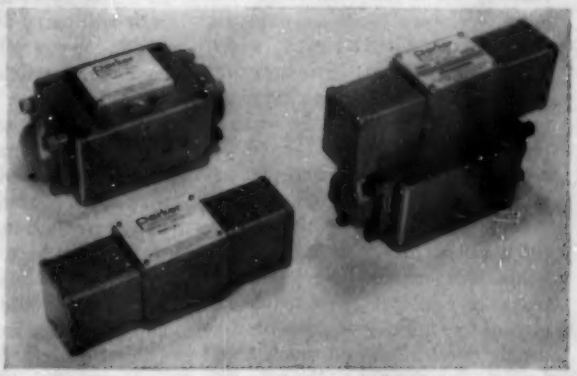
What's new for hydraulic systems?

Answer: these unique new Parker components

New Parker control valve for mobile equipment positions a load more gently and exactly than any other valve. It has full feathering on both open-center and cylinder ports. Unique spool notches provide sensitive rate-of-flow control during crossover. It's offered in 1, 2, 3 and 4-spool designs with capacities up to 35 g.p.m.



New Parker piston-type accumulator has unique design that avoids wear and maintenance, provides greater safety. It's offered in 11 sizes. Oil volume capacities range from 10 to 1,155 cubic inches; maximum operating pressure rating is 3,000 psi.



New Parker directional valves for hydraulic machines meet J.I.C. standards. Solenoid models have capacity of 3 g.p.m.; the capacity of pilot models is 22 g.p.m. Spools may be spring centered, offset, or two position—no spring. Operating pressure is 2,000 psi.

Parker check valves deliver full-line capacity with minimum pressure drop. You get instantaneous response and absolutely tight checking . . . without poppet chatter.

Other Parker products include O-rings, *Hoze-lok* fittings, *Triple-lok* flare fittings, *Ferulok* flareless fittings. More Parker fittings are used on machinery than any others.

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Section 204-F
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Hydraulic and fluid system components

APPLIED HYDRAULICS

Fluid Power Lines

Fireman's Delight

Last spring Ed Nichols took us out to Rockwood Sprinkler Company's proving grounds which are used for checking out fire fighting equipment. This place is really a haven for all thwarted firemen and possibly for a few delinquent firebugs. We were too busy enjoying ourselves to determine in which category we belonged. The fires they start and the equipment they use to put the fires out are equally phenomenal. We should have become a fireman as we had planned at age seven.

Making our visit highly successful is Ed Nichols' article which appears this month. Oil hydraulics plays an important part in the design of fire fighting equipment. Ed's article doesn't tell you much about how to put out fires. He tells you about the design of master and slave circuits which control the motion and position of the equipment.

Simple Hydraulic Transmission

Selecting a hydraulic drive can often be done by comparing the torques, power and speeds you wish with the performance curves of standard pumps and motors. If the requirements of your machine are firmly established and they are realistic, the selection of the transmission is not difficult. Gene Roberts shows you, in his article, how a drive for a paper mill machine was selected. Although this particular drive is the simplest type available, you'll find that his procedure is applicable to many machines. Designers who have not had experience in selecting transmissions will find this article helpful. And if you aren't too familiar with what a hydraulic drive will do to improve machine performance be sure to read this article.

Will it Ever Happen . . .

. . . that hydraulic circuits on aircraft will carry 5000 psi? You can decide for yourself. Joseph N. Steinmetz, Jr's. article in this month's Aviation Section is a comphrensive analysis of the advantages and disadvantages. Some British aircraft are using a 4000 psi system—but that doesn't mean the 5000 psi system is just around the corner. That corner may be a long time in coming. For one thing, higher pressures mean higher fluid temperatures, and temperatures are becoming more critical on jets. But someone might come up with a new fluid having different temperature characteristics. Or maybe the 5000 psi pneumatic system described by Bert Schmidlin last month is the answer. You'll find that Joe Steinmetz's "Power in a Smaller Package" will bring you up-to-date on 5000 psi aircraft hydraulic systems.

Excited about a Clamp

Everywhere we go we find a hydraulic clamping device. While one of these days we may be found muttering . . . a clamp is a clamp, is a clamp, is a clamp . . . up to now we seem to find rather interesting clamps—at least one out of every couple hundred anyway. This month, three engineers who work in one of MIT's labs tell about a rather unusual clamp which holds sections of a 100 foot, 5 ton "shock tube" together. To us, what they do with the shock tube is rather interesting even though we don't have any need for one. You too will find the shock tube itself interesting; however, of greater value to you is the electrical control system which makes the clamping system safe.

Build a Test Stand to Check Air Tools

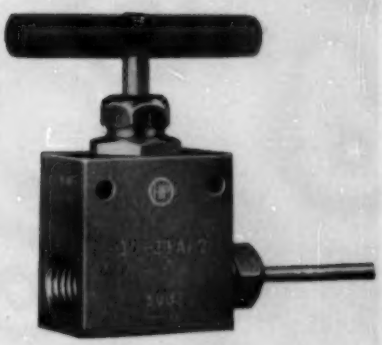
In April, APPLIED HYDRAULICS published an article which told how Ryan Aeronautical Company set up a maintenance program which is saving them about $20,000 a month. Special test carts for checking pneumatic tools are an important part of this money saving program. Readers asked for more information about the design of these carts which can save operating dollars in many plants. We asked the Ryan methods engineers for material which is used in the article on page 62. A detailed description of all the parts of the test stand is given.

Higher Pressures

It's not uncommon today to require from 5000 to 10,000 psi at the work. The usual method of developing these pressures is with an intensifier which works on the very basic principle dating back to Pascal. The intensifier makes it possible to keep high pressure in short lines and thereby eliminates the troubles of a complete high pressure circuit.

The design of the intensifier becomes the important part of the circuit. When commercial boosters or intensifiers won't do the job, the booster construction suggested in Frederick J. Shaltz's article may be your answer.

Precision "O" Ring holds 15 tons pressure in this HIP Midget Valve!



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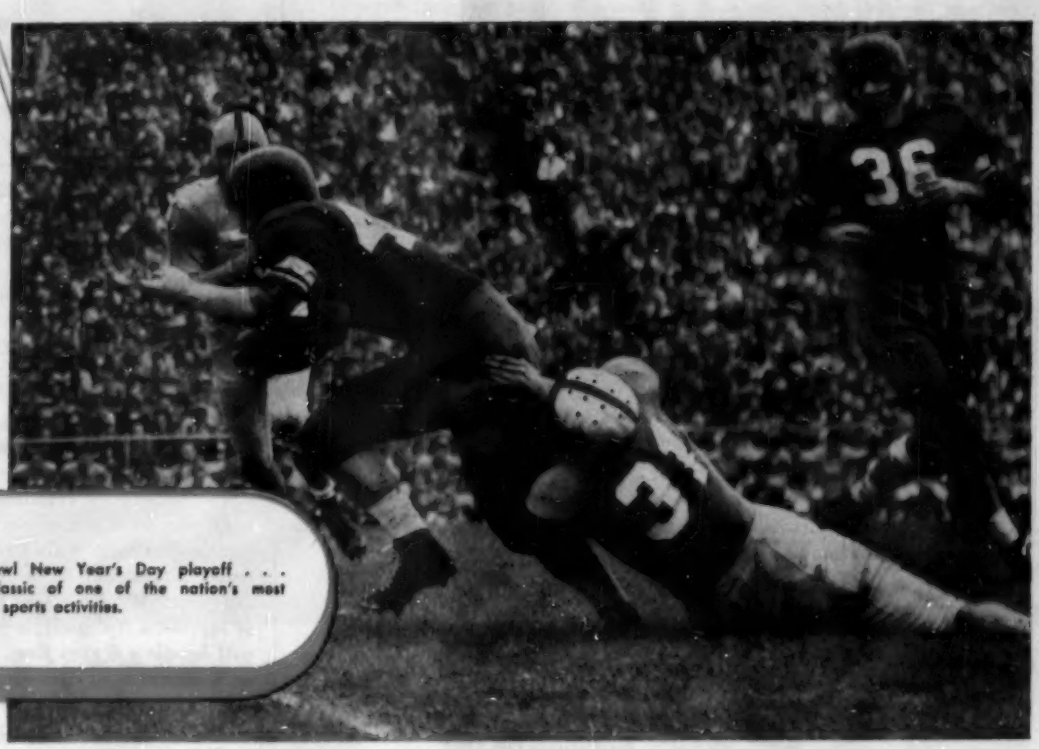

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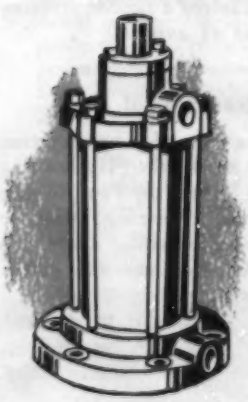

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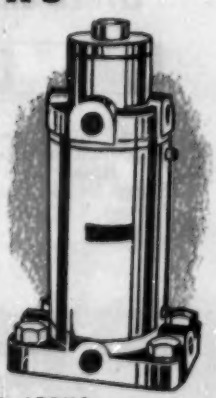

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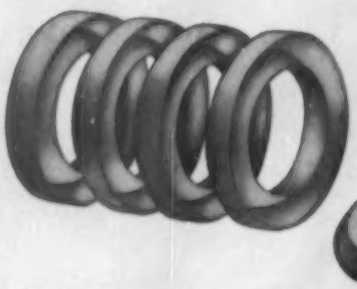

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Wants a Solenoid Valve

We would appreciate your advice in locating the following: A single solenoid operated valve for industrial equipment that will permit a 6 gpm flow of 300 SSU hydraulic oil at about 10 psi pressure drop. Operating pressure is 60 to 120 psi and the frequency of operation will be every 10 seconds. A normally closed valve that will shut off flow without seepage or drain to the reservoir is required. The pressure and flow will be from either direction alternately.

R. N. WINTERS
Electronics Div.
Westinghouse Electric Corporation
Baltimore, Md.

If you have not already tried a standard single solenoid 4-way valve, this would be a good starting place. We have sent you a list of suppliers. Normally, a 3/8 in valve will handle a 6 gpm flow. However, with such a high viscosity and your requirement for only 10 psi pressure drop, we would suggest that you go to a 3/4 in valve. Your requirements are unusual for standard oil hydraulic valves. Perhaps a reader who has solved a similar problem can give us an answer.

Hydraulic Drill Feed

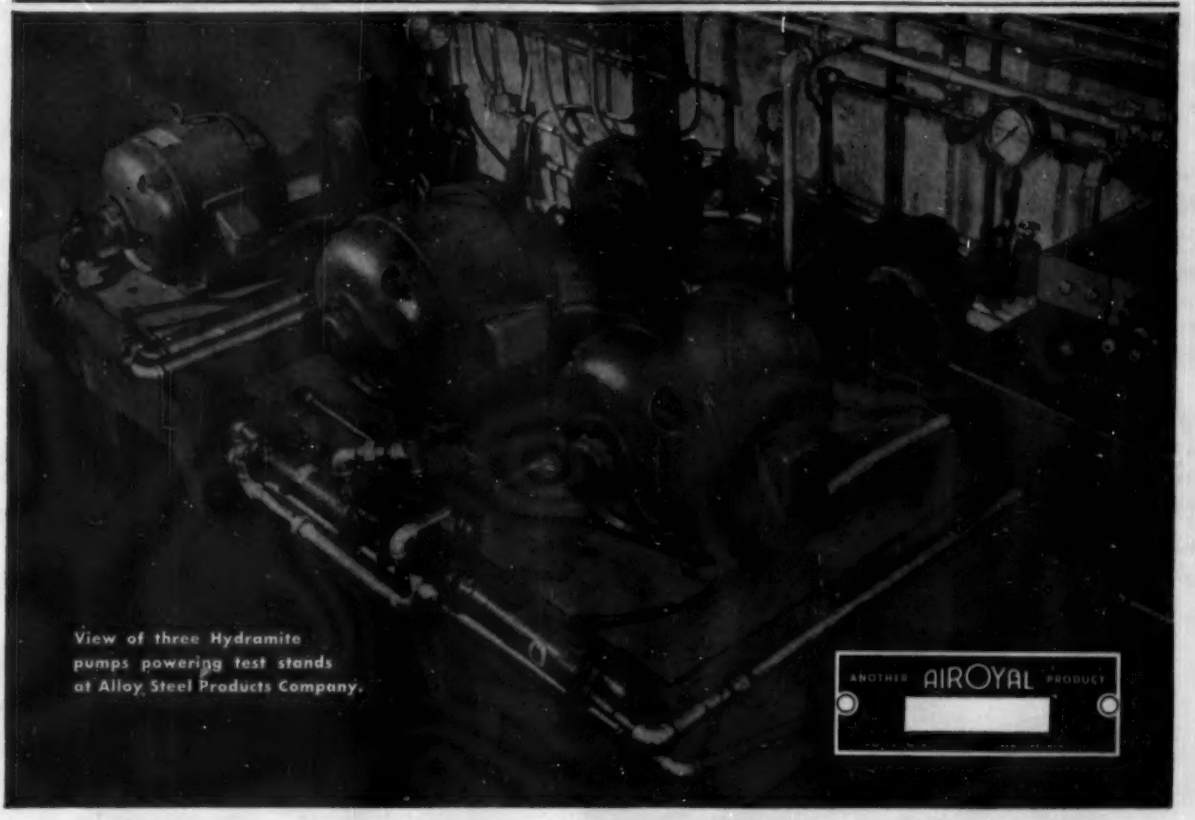
The June issue of your magazine contained an article "Hydraulic Drill Feed Design" by Paul Romine and Andrew Armstrong. May we have more information about this device? We are interested in the source of supply.

O. W. MANDELL
Acragage Corp.
Milford, Conn.

This is a new design. The patents are held by Paul Romine, 25689 Ford Street, Roseville, Michigan. Mr. Romine can supply you with additional information about the drill feed unit.

Continued on page 14

WHEN IT'S HIGH PRESSURE, IT'S **AMERICAN!**



View of three Hydramite pumps powering test stands at Alloy Steel Products Company.

AE representative provides "muscle" for valve testing

ALLOY STEEL PRODUCTS COMPANY, Linden, N. J., makers of stainless steel valves, recently needed new hydraulic units for use in hydrostatic tests. They called on The Airoyal Company who designed and produced three units employing AE Hydramite fluid power generators which actuate cylinders that clamp the valves in place while being tested. The installation has speeded up testing operations and has proved 100% reliable.

The Hydramite has rapidly become the first choice for a widespread range of hydraulically-operated equipment... and always provides the efficiency and economy associated with products of the American Engineering Company. Available in a variety of sizes, it develops pressures up to 5000 p.s.i. and operates on most of the makes and viscosities of oil suitable for hydraulic circuits.

No matter what sort of high pressure hydraulic pumping system you need, in most areas there's a nearby AE hydraulic equipment representative to save you time and expense in its engineering and construction. And from then on you can count on him to assume *local* responsibility for continuous efficient service.

Mail coupon for full information about the Hydramite for constant displacement from 3 to 100 g.p.m.; or about the Hele-Shaw for variable displacement from 1 to 110 g.p.m. and pressures to 3000 p.s.i.

AMERICAN ENGINEERING COMPANY

PHILADELPHIA 25, PENNA.

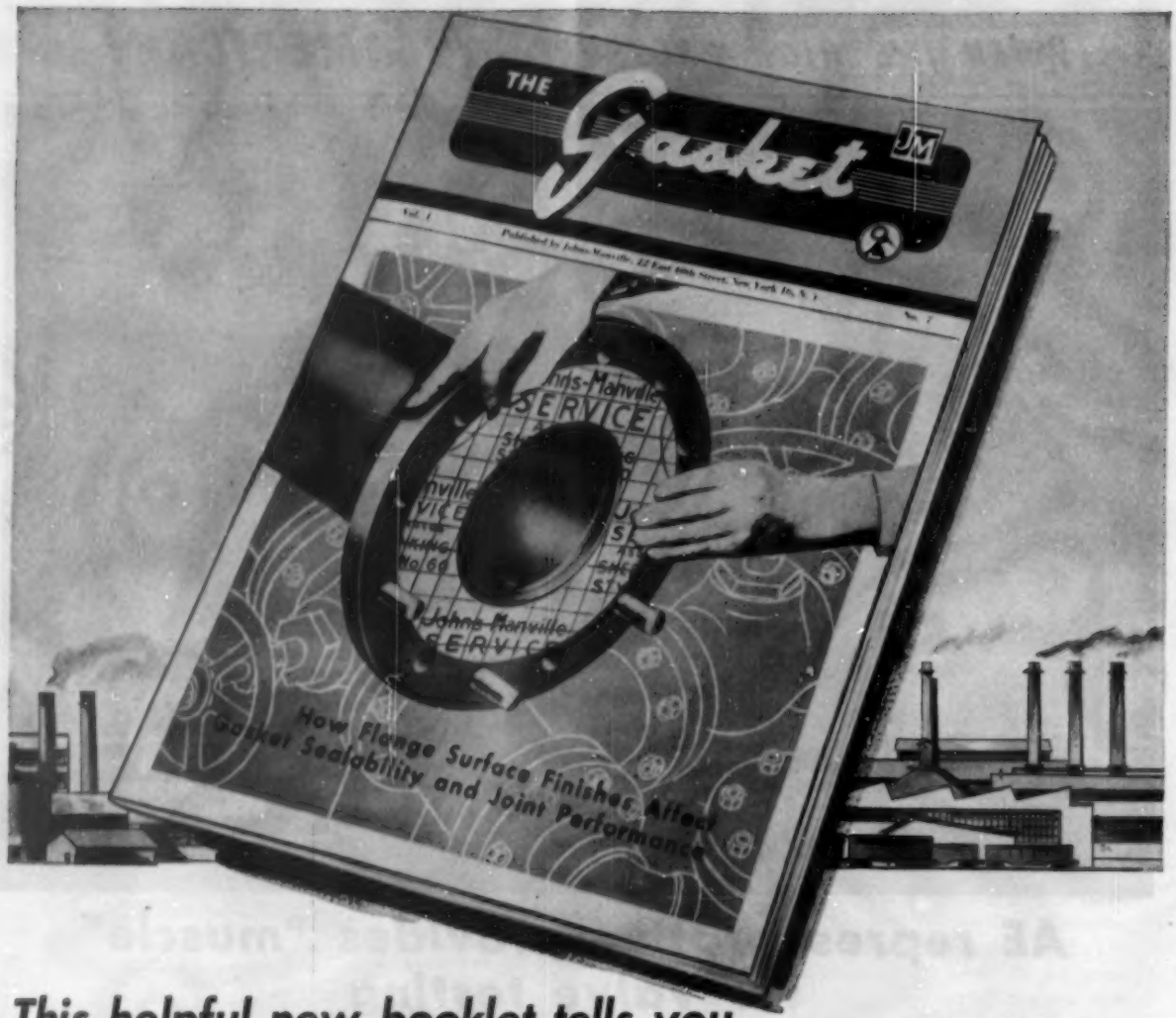
IN CANADA: AFFILIATED ENGINEERING CORPORATIONS, LTD., MONTREAL 2, CANADA

AE Products are: Taylor and Perfect Spread Stokers, Morrison Dock Auxiliaries, Hele-Shaw and Hydramite Fluid Power, Lo-Hed Hoists, Lo-Hed Car Pullers.

American Engineering Company
2530 Aramingo Avenue, Philadelphia 25, Pa.

Gentlemen: Please send me complete information about the ☐ Hydramite. ☐ Hele-Shaw.

Name.....Title.....
Company.....
Address.....
City.....Zone.....State.....



This helpful new booklet tells you

How flange surfaces affect gasket performance

IF YOU BUY, specify or design joints requiring gaskets, you will find helpful information in this new booklet. It provides a basis for selecting the flange surface finish most suitable for a given gasket. It explains why the right finish makes it easy to form the initial seal and obtain the best joint performance in service.

This booklet is the latest in a series of technical publications issued by Johns-Manville under the collective title "The Gasket." It is based on studies made at the Johns-Manville Research Center, largest laboratory of its kind in the world. It incorporates the long experience of Johns-Manville engineers in the design of gaskets such as asbestos, fibre and composition types, asbestos-metallic and all-metal gaskets.

Booklet offered without charge

To secure your copy of this study, write for "The Gasket," PK-48A No. 7. Address Johns-Manville, Box 60, N. Y. 16; in Canada, 199 Bay St., Toronto 1, Ont.

JM PRODUCTS

Johns-Manville PACKINGS & GASKETS

Circle 68 on Reader Service Card

Circle 85 on Reader Service Card

Miller HIGH PRESSURE HYDRAULIC CYLINDERS

HARD CHROME PLATED PISTON RODS
Prevent Scratch-Damage, Nicks and Rust

SOLID STEEL HEADS, CAPS and MOUNTINGS
Eliminate Breakage

DIRT WIPER SEALS
Protect Rods, Seals, Bushings

Standard Leather Cup Seal Assembly Shown Is Interchangeable With Miller Standard Piston Ring Piston Assembly

"Stock" Models For Immediate Delivery Added To Famous "Custom-Built" Line!

Rapidly expanding list of Miller "Stock" Cylinders for *immediate, off-the-shelf delivery* now includes *thousands* of different combinations of bore, stroke and model and covers both air and hydraulic cylinders—cushioned and non-cushioned.

These are in addition to Miller "Custom-Built" Cylinders available on normal scheduled delivery in an almost infinite selection. "Stock" Boosters also available for immediate delivery.

Write for Complete Catalog and Stock List!

WRITE FOR CYLINDER BULLETINS H-104 and A-105

Complete Miller cylinder line includes: air cylinders, 1½" to 20" bores, 200 PSI operation; low pressure hydraulic cylinders, 1½" to 6" bores for 500 PSI operation, 8" to 14" bores for 250 PSI; high pressure hydraulic cylinders, 1½" to 12" bores, 2000-3000 PSI operation. All mounting styles available.

MET J. I. C. HYDRAULIC STANDARDS years before their adoption in 1949.

SPACE-SAVING SQUARE DESIGN originated by Miller in 1945.

SALES AND SERVICE FROM COAST TO COAST

CLEVELAND • YOUNGSTOWN • DAYTON • PITTSBURGH • PHILADELPHIA • BOSTON • HARTFORD • NEW YORK CITY • BUFFALO • ST. PAUL • GRAND RAPIDS • DETROIT • FLINT • FORT WAYNE • SOUTH BEND • INDIANAPOLIS • MILWAUKEE • LOUISVILLE • KANSAS CITY • SEATTLE • LOS ANGELES • SAN FRANCISCO • BALTIMORE • DENVER • ST. LOUIS • MOLINE • CHICAGO • HOUSTON • TORONTO, CANADA and OTHER AREAS

Miller

MILLER FLUID POWER CO.
(Formerly MILLER MOTOR COMPANY*)*

2008 N. Hawthorne Ave., Melrose Park, Ill.

AIR & HYDRAULIC CYLINDERS • BOOSTERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS

BARCO

High Pressure Hydraulic SWIVEL JOINTS

For ¼", ⅜", ½", and ⅝" O.D. Tubing or comparable pipe sizes

THERE is no question about *performance* when you use Barco Swivel Joints designed for 3,000 psi hydraulic operating pressures. Barco's *exclusive* design gives you these important advantages:

- NO BINDING! Thanks to *side flexibility*, combined with 360° swivel (rotating) action.
- SELF-ALIGNING! Speeds up and simplifies installation. Guards against wear.
- LEAKPROOF! Precision machined and ground ball seats perfectly at any angle on flexible seal.
- EASY TURNING! Moves freely even when fully pressure loaded.
- ABSORBS VIBRATION! No metal-to-metal contact through joint. Moves in any direction.
- CORROSION RESISTANT! Offered with materials suitable for corrosive service.

Designed to meet the most critical aircraft and ordnance requirements, Barco High Pressure Hydraulic Swivel Joints are available in a complete range of standard and specially designed styles and sizes for INDUSTRIAL APPLICATIONS. *Barco Engineers are at your service; ask for information.*

STANDARD STYLES—Steel or Aluminum Casing with Stainless Steel Ball

Connections: AN, Industrial Ermeto, or Standard Pipe Threads

Send for Bulletin 269

BARCO
MANUFACTURING CO.,
532M Winnemac Ave., Chicago 40, Illinois
In Canada: The Holden Co., Ltd.

The Only Truly Complete Line of Flexible, Swivel, and Revolving Joints

FREE ENTERPRISE—THE CORNERSTONE OF AMERICAN PROSPERITY

Letters to the Editor

Continued

Low Cost Flow Meter

We would like to know where it is possible to purchase a low cost flow meter that will measure flow rates under varying pressure changes from 0 psi to 2000 psi.

ROBERT C. BARNES
Pratt & Whitney Aircraft
East Hartford, Conn.

We have sent you the names of two suppliers whose product should do your job.

Who Makes the Pump?

In your September 1954 issue, George D. Becker, in his article titled, "Built-In Air Hydraulic Jacks" made reference to a small air operated hydraulic pump capable of producing up to 30,000 psi pressure. We will appreciate your obtaining the manufacturer's address and data on this pump.

E. B. RUSSELL
Kaiser Steel Corporation
Fontana, Calif.

The pump is made by Sprague Engineering Corporation, 1144 West 135th Street, Gardena, California.

Power Steering Info

There have been various articles on the good and bad points of power steering equipment, but no information has been made available as to adjustments and repairs to these units. As specialists here in Winnipeg on hydraulic repairs and automobile steering, we are very interested in obtaining all the technical data available on all models manufactured by the various firms. We are very anxious to train men in our shop to be able to cope with power steering troubles. Please supply us with information as to the sources of further material.

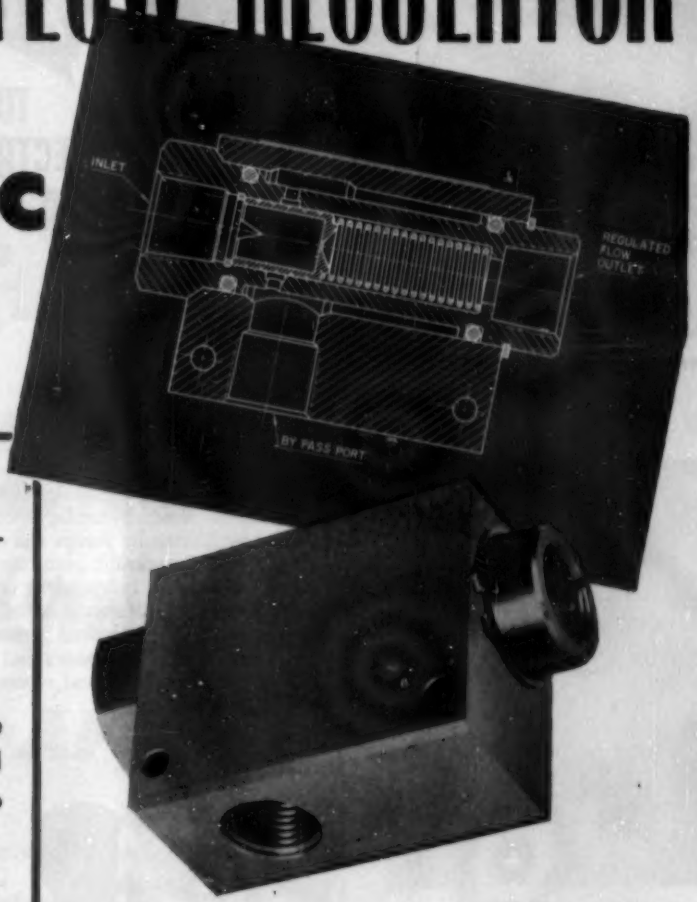
G. J. PURDY
Keystone Safety Clinic
Winnipeg, Canada

For information which will help you train men to service power

Continued on page 18

CONSTANT FLOW REGULATOR

with AUTOMATIC BY-PASS



It's another **WATERMAN FLOW CONTROL VALVE** for—

- Power Steering Systems
- Fluid Motors
- Secondary Circuits
- Or any Hydraulic Circuit where a Constant Flow Rate is required from a Variable Volume Pump Output.

BY-PASS FLOW REGULATORS relieve excess flow at working pressure resulting in—

- Reduced Oil Temperatures
- Increased Efficiency
- Less Maintenance

Look to WATERMAN for the answer to your FLOW CONTROL requirements.

Write for latest illustrated bulletin A.

WATERMAN

ENGINEERING COMPANY

725 CUSTER AVENUE • EVANSTON, ILLINOIS

PIPE BENDING IN HOLLAND

NO LIMIT

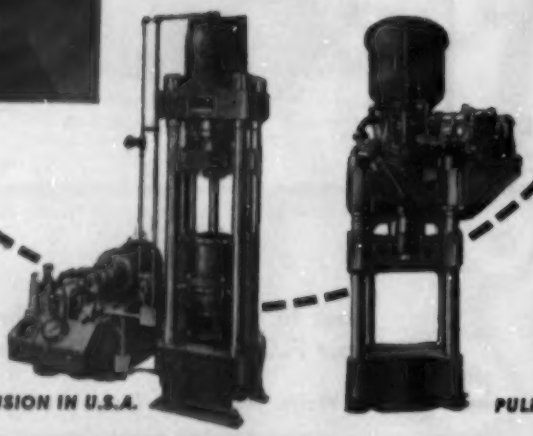
TO THE APPLICATION OF ELECTRAULIC HIGH SPEED PUMPS AND AUTODRAULIC CONTROL VALVES

All over the world, Electraulic high speed pumps and Autodraulic control valves (no solenoids) give consistent performance over a wide range of applications. A direct hydraulic system powered by Electraulic pumps and operated by the Autodraulic push-button control system is an independent unit, unaffected by the demands of other machines, giving any desired pressure at fingertip control—it cannot fail to give increased efficiency and economy in *your* plant.

FORGING IN SWEDEN

IN-LINE PLUNGER PUMP

Electraulic Twin Straight-in-Line Plunger Pump, mounted in a steel bed-plate tank.



EXTRUSION IN U.S.A.

PULP BALING IN CANADA.

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HIGH SPEED PUMPS

DIRECT HYDRAULIC SYSTEM

TOWLER BROTHERS (PATENTS) LTD. RODLEY, NR. LEEDS ENGLAND

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TR. 43.

choose O-M cylinders for improved

EFFICIENCY

DESIGN

APPEARANCE

Here's the cylinder made to order to meet industry's growing demand for machines that are more functional, cleaner-lined, less cumbersome. You don't sacrifice bore size in tight quarters when you specify O-M Air or Hydraulic Cylinders. *SPECIAL INTERLOCKING MECHANISM* does away with bulky tie rods, end caps . . . *saves up to ⅓ installation space!* Interlocking feature also provides perfect alignment, lower coefficient of friction which makes possible smoother performance at low or high speeds regardless of length of stroke. Easily removed, inspected, repaired. Completely interchangeable parts.

fit where others won't!

Available in full range of sizes (1½" to 8" bores) with standard, 2 to 1 or oversize rods. All steel construction with bearing bronze. *14-day delivery on most sizes.*

Mail coupon now!

for FREE catalog and complete set of ½ and ¼-scale templates showing all cylinders and mounting brackets.

ORTMAN-MILLER MACHINE COMPANY
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☐ Have representative call ☐ Send latest catalog
☐ Send ¼-scale templates ☐ Send ½-scale templates

Name _____ Position _____
Company _____
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New... FreeFlow GASKETS

JOHN CRANE

made of TEFLON*

"JOHN CRANE" FreeFlow Construction
Gasket flush with pipe I.D.—allows completely unrestricted flow.
No air pocket—insert flush with I.D. of envelope. No danger of rupture due to expansion of entrapped air at high temperatures.
AIR
Ordinary "Wishbone" Construction
Envelope extends beyond I. D. of pipe, causing flow restriction and turbulence.
Expansion of entrapped air at high temperatures presents danger of gasket rupture.

FOR EVERY CORROSIVE SERVICE

"John Crane's" FreeFlow construction and chemically inert Teflon have been combined as *the* answer for gaskets in corrosive service. This new construction assures a flush fitting with the I.D. of the pipe and the inner wall of the Teflon envelope, not possible with the ordinary "wishbone" type gasket. (See drawing above).

This means elimination of:

1. Flow restriction and turbulence in the line.
2. Danger of rupture at high temperature due to entrapped air between gasket insert and Teflon envelope.

"John Crane" Teflon FreeFlow gaskets are impervious to practically every known chemical or gas and are unaffected by temperatures from —100° to +482°F., depending on the insert material. They are available in all shapes and sizes for a wide variety of applications, such as glass lined, porcelain, pyrex and similar equipment, including reactor kettles and pipes, distillation columns and nozzles.

Request full information on "John Crane" FreeFlow gaskets for your particular requirement. Ask for our informative booklet, *The Best in Teflon*, for other important technical and application data. Crane Packing Company, 1805 Cuyler Avenue, Chicago 13, Illinois. *In Canada: Crane Packing Co., Ltd., 617 Parkdale Ave., N., Hamilton, Ont.*

DEPEND ON "JOHN CRANE" TEFLON PRODUCTS

*DuPont trademark

JOHN CRANE CRANE PACKING COMPANY 38 YEARS INDUSTRIAL PROGRESS

Letters to the Editor

Continued

steering systems on automobiles, we suggest that you write to the service divisions of all the automotive companies and to the following suppliers of hydraulic power steering units: Ross Gear & Tool Company, Saginaw, Michigan, Gemmer Manufacturing Co., 6400 Mt. Elliott Ave., Detroit, Mich., Saginaw Steering Gear Div., General Motors Corp., Saginaw, Mich.

Special Groove Designs for "O" Rings

The attached clipping from the July issue of APPLIED HYDRAULICS (the first item on the Growing Horizons page, p8) states that longest life in "O" ring seals dictates "special installation techniques and groove designs." Please inform us where we may locate some published material on this specific subject of "special groove design."

RALPH R. HAUSE,
Hause Valve Co.

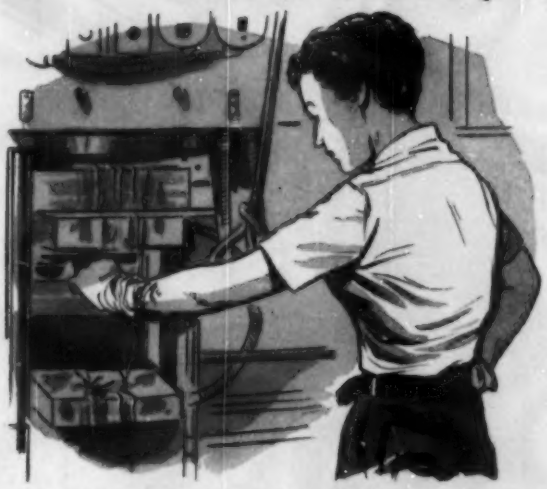
Several of the leading manufacturers of "O" rings (see advertisements in this issue) have published catalogs or manuals in which some data on special grooves is given. Field representatives of these companies could be helpful in your specific design problem. Groove designs are critical on "O" ring rotary and reciprocating applications.

Reprints and Back Issues

We can normally supply single copies of back issues of APPLIED HYDRAULICS 3 to 6 months back. Older copies normally cannot be furnished, many issues further back are out of print. We can however, supply photostatic copies of individual articles from such issues. Here is a list of recent reprints, copies of which are available as long as the present supply lasts: "Fluid Power Circuits", reprinted from the January, 1954 issue, $.50; "Growing Horizons for Fluid Power", reprinted from the January, 1953 issue, $.25; "Servomechanisms for Industry", reprinted from the September, October and November,

Continued on page 22

Suntac Cuts Hydraulic Leakage 90%



Hydraulic ram for injection molding press leaked excessively, using ordinary hydraulic oil. Make-up ran approximately 8 gallons per week.

Leaking oil dripped on hot platen and splashed onto operator, causing burns, spotted clothing, and generally untidy condition around the press.

Packings required changing at least once a month—frequent adjusting. Down time for maintenance seriously reduced productivity.

Changed to SUNTAC. Make-up oil now running only about ½ gallon per week. Operators are happier, and productivity greatly increased.

If you have a leaky hydraulic system, remember this: SUNTAC is the hydraulic oil especially compounded to reduce leakage. Special additives make the droplets cling together . . . keep them from leaking through packings. Experience has proved that SUNTAC will cut leakage an average of 35%. Get complete information about SUNTAC Hydraulic Oil from your Sun Oil Co. representative. Or write Dept. AH-11

INDUSTRIAL PRODUCTS DEPARTMENT

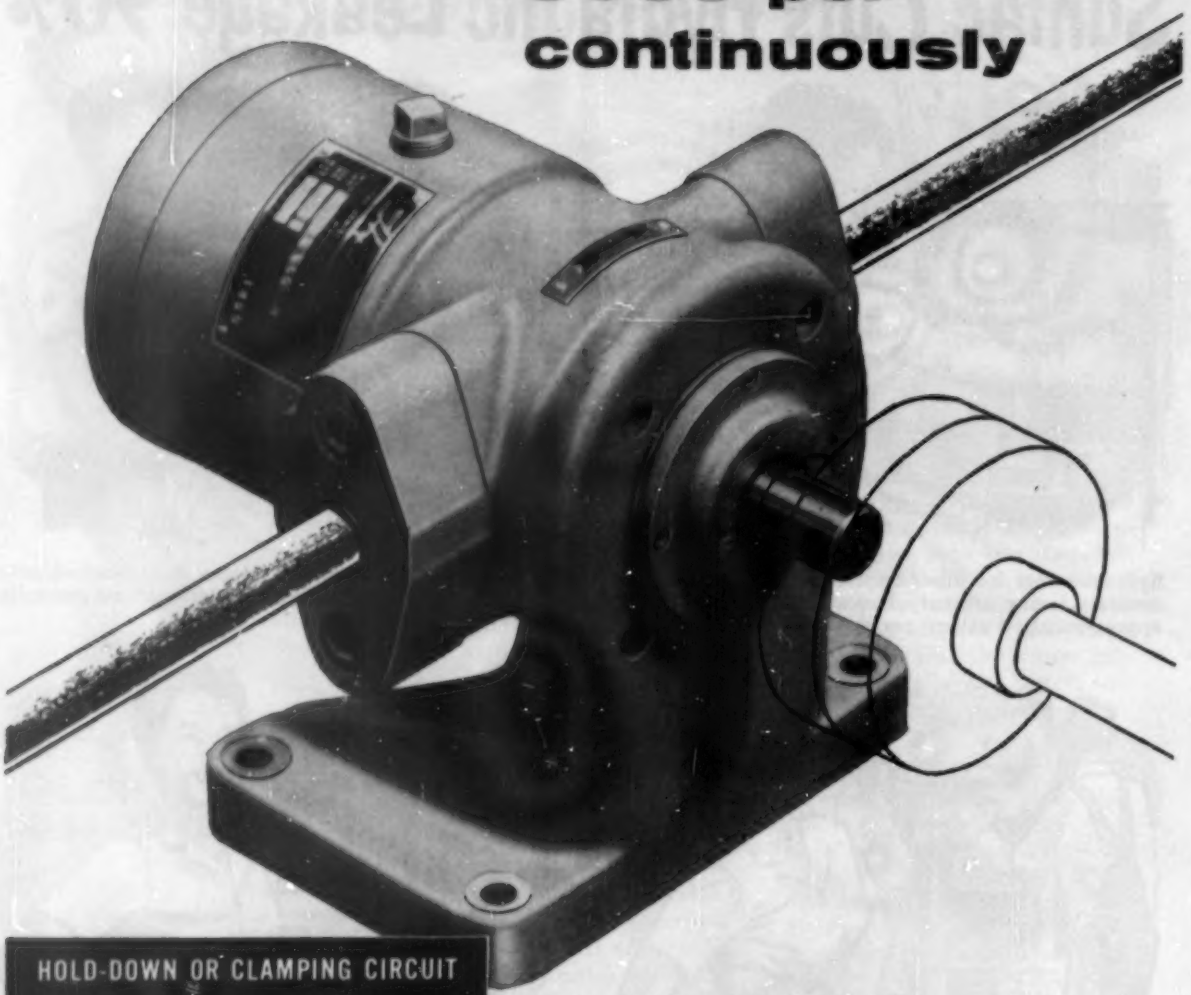
SUN OIL COMPANY

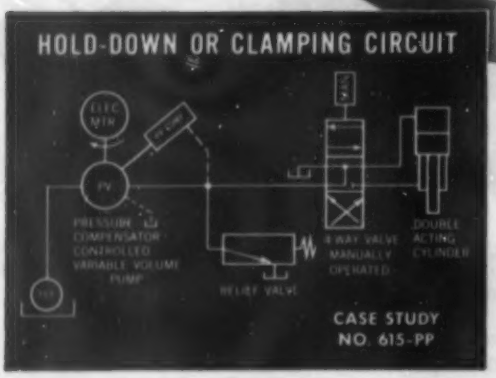
SUNOCO®

PHILADELPHIA 3, PA. • SUN OIL COMPANY LTD., TORONTO & MONTREAL

Refiners of famous High-Test Blue Sunoco Gasoline

5000 psi— continuously





Denison Axial Piston Pumps operate continuously at 5000 psi, deliver up to 35 gallons per minute

Few hydraulic pumps can operate at 5000 psi. And, if they can, it's for only a few seconds at 5000 psi. Not so with Denison Axial Piston Pumps. They deliver up to 35 gpm at 5000 psi . . . continuously. Yet they cost no more than many pumps with lower pressure ratings.

Three sizes deliver 10, 20 and 35 gpm. Available in constant or variable volume types . . . with handwheel, pressure-compensating, stem or cylinder volume controls. Mountings: Face, flange or foot.

The circuit shows a Denison Axial Piston Pump in a hold-down or clamping circuit. Write us for bulletins about Denison pumps.

DENISON Hydr**OIL**ics

PUMPS • MOTORS • CONTROLS • PRESSES

THE DENISON ENGINEERING COMPANY
1166 Dublin Road • Columbus 16, Ohio

Power! Control!! Production!!!

with Schrader Valves

Compressed air, plus automatic control, has given industry a muscle-saving power to produce more economically . . . without fatigue . . . with increased production.

Reliable valves are an absolute necessity. And **Schrader Valves** are the accepted solution, wherever air controls are used. Schrader Valves are designed and built by a company whose success dates back to 1844—more than a century of experience in air control.

In the complete line of Schrader Valves you'll find two-, three- and four-way models . . . for hand, foot, tripper, cam, pilot or solenoid operation . . . for practically any application.

Compressed air has become a *must* in every plant. If you are not now using it, *investigate* it. And—wherever you actually use compressed air—you'll make its use most effective if you use the best valves possible—Schrader Valves.

Find out how you, too, can put compressed air to work to save you money. For details, write—or, if you prefer, fill out the coupon below.

Schrader

REG. U. S. PAT. OFF.

Leaders in air control since 1844

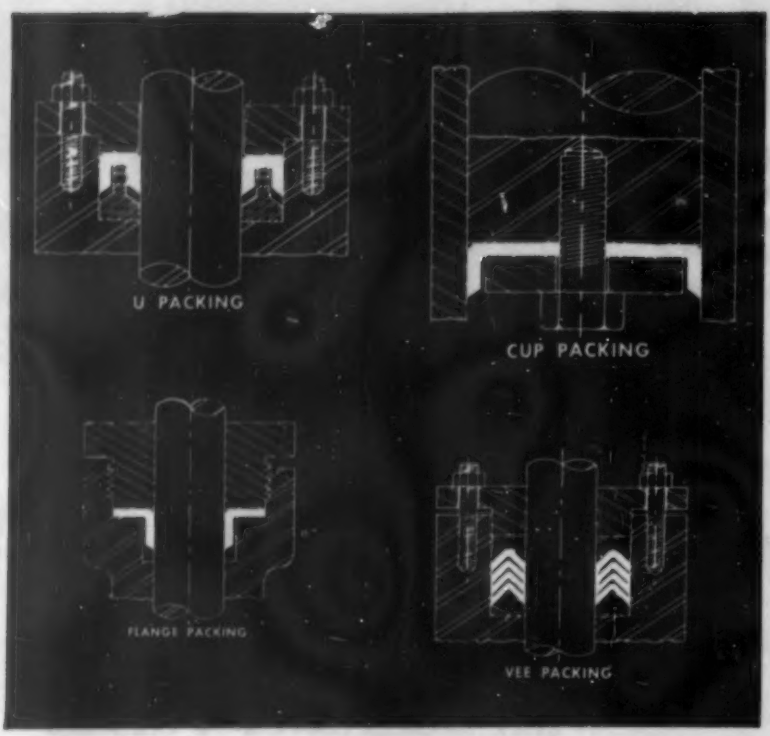
A. Schrader's Son
Division of Scovill Manufacturing Company, Incorporated
456 Vanderbilt Avenue, Brooklyn 38, N. Y., Dept. B-4

I am interested in more information on _____

Name _____ Title _____

Company _____

Address _____



It's hard to beat these advantages of Tannate® Leather Packings

1. They do not require lubrication
2. They do not readily coldflow
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You get all these special advantages from Tannate Leather Packings because they are tailor made from special tanned Tannate Leather, custom impregnated to meet your requirements.

If you have a special need for a packing that will seal better and last longer, specify Tannate Leather Packings.

RHOADS
INDUSTRIAL LEATHERS

PHILADELPHIA • NEW YORK • CHICAGO • ATLANTA

Letters to the Editor

Continued

1953 issues; "Design of Hydraulic Systems for Heavy Presses", reprinted from the October, November and December, 1953 issues; two of the 1953 Prize Winning Papers —"New Hydro-Air Power Unit Offers More Speed, Force and Control" from the October, 1953 issue and "Design of a Hydraulically Operated Biaxial Fatigue Testing Machine" from the December, 1953 issue; "Application of "Shear-Type" Sleeve Fittings, reprinted from the March, 1953 issue; "Bonded Seals . . . How and Where to Use Them", reprinted from the May, 1954 issue; "Electronic Instrumentation . . . Techniques for Hydraulic Application", reprinted from the April, 1953 issue; "High and Low Range Aniline Point", reprinted from the April, 1954 issue; "High Oil Pressures Widen Applications in New Mill Design", reprinted from the May, 1953 issue; "Simplified Valving", reprinted from the February, 1954 issue; "Three Pressure Switch Controlled Accumulator Circuits", reprinted from the June, 1954 issue; and "Winch Design Uses Hydraulic, Gear and Belt Drives", reprinted from the March, 1953 issue. Where no price is noted, individual copies will be furnished without charge.

Beginner's Courses

I have heard that you plan to publish in book form the courses in basic hydraulics and basic pneumatics. If true, when will copies be available. Is it possible to secure back issues of APPLIED HYDRAULICS which contain installments of both these series? I am planning to use these lessons in outlining a course for our own use.

WARREN F. DECKER,
Packing Product Mgr.,
J. E. Rhoads & Sons

We did not reprint the series "A Beginner's Course in Basic Hydraulics" which appeared in APPLIED HYDRAULICS during 1949-1951. However, we have reprinted, "A Beginner's Course in Basic Hydraulics" in booklet form. Single copy price is $1.00; *20-99 copies, 90 cents each; 100 or more copies, 80 cents each.*

dependable NAMCO

"STELLITE"-WELD

Solenoids

do those hidden jobs *Automatically*

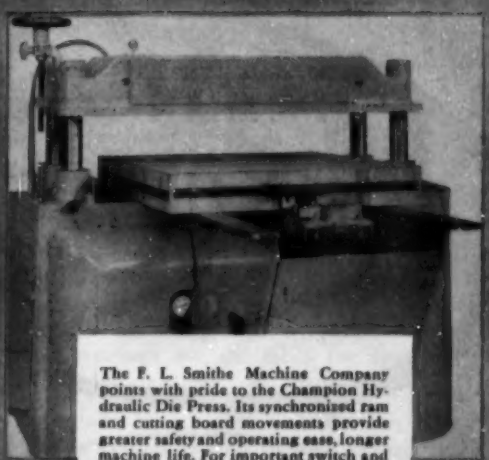
Solenoids offer you a modern, up-to-date way of doing jobs automatically, by remote control—even in cramped quarters. You can simplify design, manufacture and operation—with the positive, accurate action of Namco "Stellite"-weld Solenoids.

Many manufacturers with a cost or space problem have found the solution in these compact reliable solenoids. They're using them in the place of expensive and bulky gear trains, levers, linkages and other mechanisms. They're getting better products (usually at lower costs) by using Namco Solenoids to

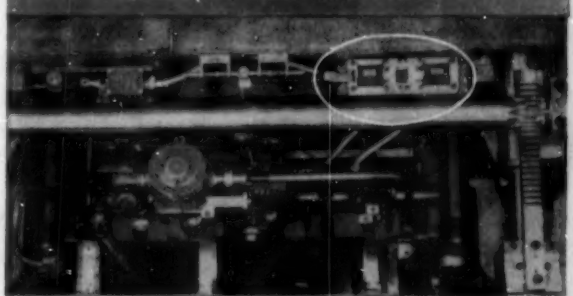
ACTUATE CLUTCHES	ACTUATE CLAMPING
OPERATE SWITCHES	HOLD CHUCKS
CONTROL MACHINES	OPERATE VALVES
MOVE LEVERS	VIBRATE CUTTING KNIVES
PRINT SYMBOLS	OPEN AND CLOSE DOORS
OPERATE SAFETY DEVICES	OPEN AND CLOSE HOPPERS
EJECT WORK IN PROCESS	SORT INSPECTED PARTS

Namco "Stellite"-weld Solenoids are built in sizes with ratings from 2½ to 25 pounds, push or pull, at maximum 1" stroke. We'll be glad to recommend the size and style best suited to your job—ask our engineers to talk it over with yours.

Engineering BULLETIN EM-52 gives details on standard Namco Solenoids.



The F. L. Smithe Machine Company points with pride to the Champion Hydraulic Die Press. Its synchronized ram and cutting board movements provide greater safety and operating ease, longer machine life. For important switch and solenoid components, they chose Namco Snap-Locks and "Stellite"-weld solenoids.



Packaging machines, shearing devices, valves, envelope machines and many others perform better longer with Namco Solenoids. "Stellite"-weld and hard chrome plate bearing pin plunger, sturdy construction and highest quality coils make Namco Solenoids long lived, rugged, DEPENDABLE.

ELECTRICAL MANUFACTURING DIVISION

The NATIONAL ACME COMPANY

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ACME-GRIDLEY
BAR and CHUCKING AUTOMATICS
1-4-6 and 8 Spindle • Hydraulic Thread Rolling Machines • Automatic Threading Dies and Taps • Unit, Motor Starter and Control Station Switches • Solenoids • Contract Manufacturing

STAYNEW FILTERS' DOUBLE ACTION

Guards Against Water, Oil and Pipe Scale

MECHANICAL SEPARATION

1. Deflector cup directs flow of air or gas together with water, oil and dirt to the walls of the housing and then downward at high velocity into the base where liquid and heavier dirt particles are deposited.

FILTRATION

2. Air or gas, having been mechanically cleaned, rises at low velocity through the Radial Finned Filtering element or insert which removes the lighter air-borne material.

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PIPE LINE FILTER

This exclusive Double-Action principle of Staynew Pipe Line Filters assures sustained, trouble-free operation. Inexpensive, quickly installed and easily maintained, these filters keep air operated or controlled equipment free from pipe scale, dust, dirt, and condensate. Wherever you require air and other gases *clean* and *dry*—demand and get—Staynew Pipe Line Filters.

Write today for complete Staynew Pipe Line Filter Bulletin B-1A.

Representatives in Principal Cities

DOLLINGER AIR MOTOR PROTECTION STAYNEW FILTERS

DOLLINGER CORPORATION

65 Centre Pk., Rochester 3, N. Y.

ALL TYPES OF FILTERS FOR EVERY INDUSTRIAL NEED

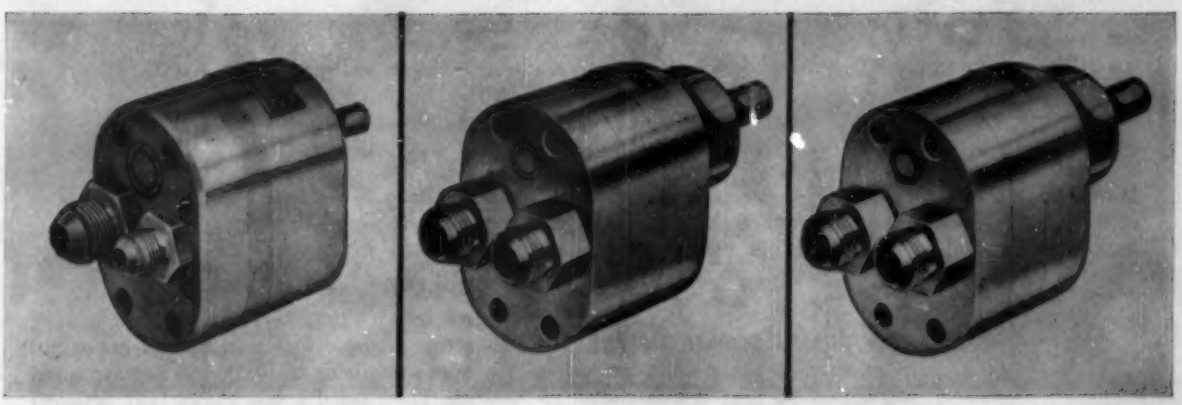
specify with confidence...

HYDRAULIC PUMPS FLUID MOTORS

Design engineers have confidence when they specify dependable Eastern Hydraulic Pumps and Fluid Motors. Exclusive Eastern features create an economical, reliable, and compact unit for the heart of your hydraulic mechanism.

Lightweight construction of aluminum alloy housing, nitralloy gears and shaft, and close tolerances assure longer service, higher volumetric efficiency, and more dependable operation. Various types of mountings are available for space saving installation.

In many cases by specifying an Eastern unit you realize dollar savings as well as great savings in size. They cut operating costs by keeping space requirements and weight to a minimum.



100 Series — Heavy duty gear pump. Delivery from .1 to 5 gpm and working pressures up to 1,500

700 Series — High pressure gear pump. Delivery from .6 to 9.6 gpm and pressures up to 1,500 psi.

2700 Series — Gear type fluid motor. Torque output — 0 to 15 ft. pounds.

Send for Eastern Hydraulic Catalog F-800. Contains valuable engineering diagrams and information.

Eastern INDUSTRIES, INC.

296 ELM ST., NEW HAVEN, CONN.

GROWING HORIZONS FOR FLUID POWER

NEWS • ACTIVITIES • PLANS

STANDARDIZING CYLINDER mounting dimensions may not be too far off. One cylinder manufacturer recently made a comparison chart of dimensions covering cylinders made by eight different manufacturers. The similarities are quite surprising. It seems quite possible that cooperation between manufacturers could result in interchangeability similar to that provided by electric motor standards.

TENTATIVE DRAFTING STANDARDS MANUAL for hydraulic and pneumatic systems has been published by The American Society of Mechanical Engineers. These are proposed American Standards which are still subject to revision. This manual shows methods of preparing pictorial, cutaway and graphical diagrams. Symbols for all components are given. Graphical symbols follow the established JIC standards. This manual, when it has been fully approved, will greatly assist in the preparation of clear, uniform circuit drawings for fluid powered machines.

LAST MONTH PRESIDENT EISENHOWER became an operator of an oil powered bulldozer. Without any practice, he did a masterful job. Actually, the operation of the bulldozer was just incidental to the occasion which was the ground breaking for the first U.S. commercial atomic power plant. The President was in a television studio in Denver and the bulldozer he was operating was 1300 miles away at the Shippingport, Pa. plant site. To our knowledge it was the first time that remote actuation of hydraulic controls has been carried out over this distance. It was certainly the first time that a bulldozer had an "atomically actuated" hydraulic system. The President waved a radioactive wand over a fission counter. Movement of the counter's needle set the bulldozer in action. We might guess at the details of the actuating system. But it really doesn't matter. It is just another example of the great flexibility of control offered by hydraulic power.

NEW PUMPS FOR HIGH PRESSURES are now available. One manufacturer has recently introduced a pump which will deliver 5 gpm at a maximum of 10,000 psi. Another model will deliver 10 gpm at a maximum of 5000 psi. These radial piston pumps offer designers new possibilities in creating machines which are smaller and deliver greater power. Development of these pumps puts the burden of further advances with high pressure on valve manufacturers. Also, that everpresent problem of leak-free plumbing takes on greater importance.

"PRODUCTION PROCESSES are becoming so complicated," says D. S. Harder, vice president-manufacturing, Ford Motor Company, "that I believe a preventive maintenance program is a must. Extended use of the principles of automation will make this mandatory in a well managed plant. The purpose of a preventive maintenance program is to determine the anticipated life of perishable parts of our mechanical equipment and to see that these parts are replaced before a complete breakdown occurs. Lack of preventive maintenance program can soon cause an adequately engineered production line to disintegrate into a low producing, high cost system."

Diversatility rides again

in the new COMPLETE line of SPEED KING

Valvair Solenoid Pilot Operated Control Valves

Valvair Speed Kings are small, light in weight, with a speed of 600 cycles per minute, and proven capable of 20,000,000 cycles and up.

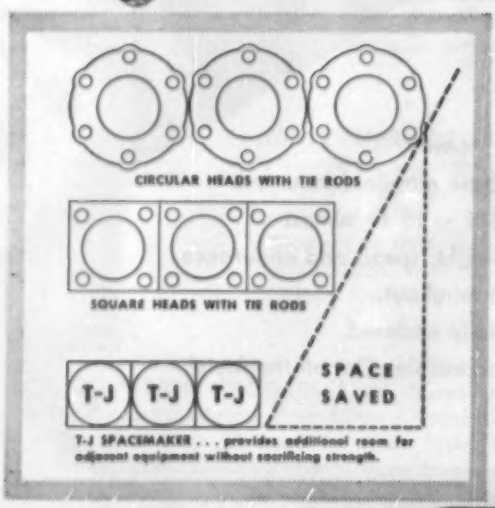
The New Valvair Speed King line is complete — 3-way, 4-way, and 4-way-5-port (2-pressure), foot-mounted or sub-base manifold mounted; pipe sizes — ¼", ⅜", ½", ¾", 1". COMPLETE — to fit almost innumerable applications. A precedent-breaker in size, weight, speed and endurance. Only two moving parts. Non-corrosive materials throughout. Solenoid and pilot valve parts are totally enclosed, but easily accessible. *Get all the facts!*

VALVAIR CORPORATION *Affiliate: Sinclair-Collins Valve Company*
951 BEARDSLEY AVE., AKRON 11, OHIO
REPRESENTATIVES IN PRINCIPAL CITIES

Rely Upon Valvair DIVERSATILITY

Ask for Bulletin "AH-9"

Circle 125 on Reader Service Card



T-J Spacemaker CYLINDERS

OIL pressure to 750 — AIR to 200 P. S. I.

Now the sensational new T-J Spacemaker sets the pace in compact cylinder design and efficient performance!

New "Self-Aligning" adjustable oil cushion means faster acceleration and better cushion than ever before . . . New T-J Super Cushion Flexible Seals for air insure positive cushion with automatic valve action for fast return stroke.

More plus features include—heavy wall, precision honed, hard chrome plated, seamless steel body . . . leakproof cylinder head to body construction . . . heavy duty, high-tensile, *hard chrome plated piston rod.* Write for bulletin SM-454-2. The Tomkins-Johnson Co., Jackson, Mich.

T-J TOMKINS-JOHNSON
RIVETORS · AIR AND HYDRAULIC CYLINDERS · CUTTERS · CLINCHORS

GIVES YOU ANY RPM—
AND ONLY 14¼" HIGH!

FRACTIONAL HORSEPOWER

VARIABLE SPEEDS —IN SMALLEST PACKAGE

HERE'S the new variable speed motor that cost-conscious plant operators have long sought. It's the light weight U. S. Varidrive, Type VA, compactly dimensioned to occupy least space, yet suitable for rugged industrial duty just like the larger HP Varidrive line. Compact dimensions and light weight now make built-in application of variable speeds practical. You can mount it right on your machine, close in; or in any position on floor, wall or ceiling, with or without remote control.

4 TO 10,000 RPM
IN RATIOS UP TO 10:1

Quick, Accurate Dial Control

Full speed range instantly obtained in less than one turn of dial handle. The stationary dial plate is precisely calibrated for close speed setting, yet easily visible from a distance.

Gets You More Production

You can greatly increase the performance and output of your machine using fractional horsepower with Type VA. You can now get the exact speeds needed for each operation. Your operator can control the speed to a split rpm to accomplish better workmanship and to actually gain more output. This amazing motor invariably repays its low-cost investment within a few weeks.

14¼" High x 8½" Wide
Weight—87 Lbs.
Easiest Dial Control
Single and 3-Phase

U.S. VARIDRIVE MOTOR

Bulletin Chock-full of Facts

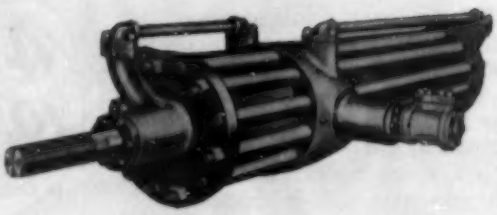
You'll want to study the internal workings of this revolutionary small horsepower motor—see how it works, note the high excellence of materials and the advanced engineering skill that makes Type VA the wonder motor. All the facts are interestingly presented in Bulletin No. 1797. Engineering details and many types shown.

U. S. ELECTRICAL MOTORS INC.
Los Angeles 54, Calif. Milford, Conn.

REQUEST VARIDRIVE BOOKLET

U. S. Electrical Motors Inc. AH-11
Box 2058, Los Angeles 54, Calif. or Milford, Conn.
☐ *Send Varidrive Bulletin 1797*
NAME_____
COMPANY_____
ADDRESS_____
CITY ZONE STATE

Look Here!



Yes, just a look at this hydraulic TRUNNION CYLINDER tells you that it's for heavy duty continuous service. What's more, NO HOSES are required due to our HYDRAULICALLY BALANCED SWIVEL PIPE CONNECTIONS. That's important when dealing with large cylinders or pressures above 1000 psi.

And this style of cylinder is only one of many, all of which embody "extra" features of design and construction; features that, as a result of our long experience in building heavy duty hydraulic equipment, mean trouble free performance.

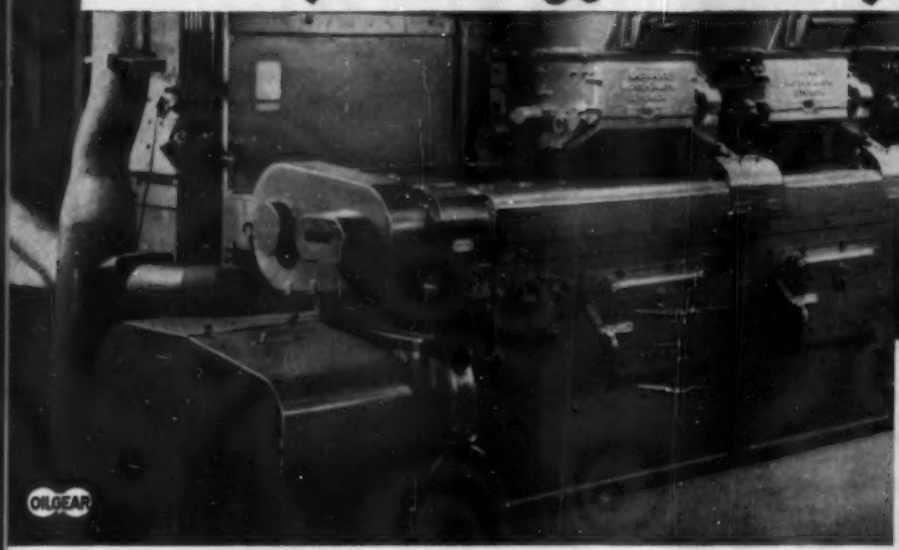
True, these cylinders are not the mass produced, "off-the-shelf" type, but they are built according to our standards and to meet your requirements. We will be pleased to receive your inquiries.

Quality EQUIPMENT for *Quality* PERFORMANCE

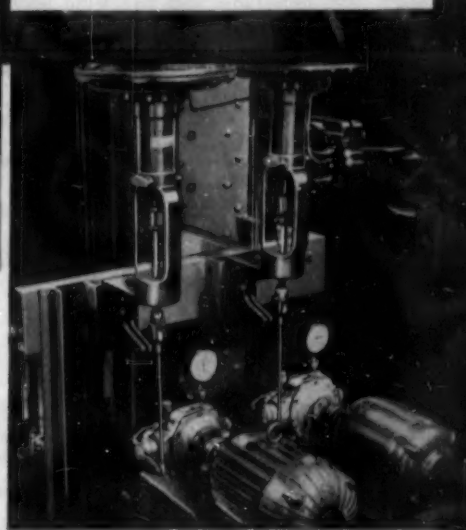
BENJAMIN LASSMAN & SON Route 8, GLENSHAW, PA.

Circle 73 on Reader Service Card Circle 91 on Reader Service Card

"ONE OF THE *Highest Efficiency Units* "IN THE UNITED STATES



View in J. I. Case Co. tractor works at Racine, Wis. Boiler front and Detroit Roto-Grate Stoker on 100,000 lb. per hr. boiler unit.



Two Oilgear Variable Delivery Pumps with simple diaphragm actuated hydraulic servomotor lever controls supply fluid power for the fuel feed and grate drives. An Oilgear drive was experimentally installed on the fuel feed on the first stoker in 1948. On the basis of its performance, Oilgear drives were used for both fuel feed and traveling grate on a second stoker unit installed in 1949. Also, Oilgear will replace the mechanical grate drive on the first stoker installed in 1943. Like a shadow, flexible, controllable Oilgear *Fluid* Power causes fuel feed rate and grate speed to accompany steam demand up and down. Recording charts show steam *demand* varies "all over the place," but steam pressure and fuel air ratio stay steady.

And Oilgear's Range and Control help capture savings hidden in J. I. Case 100,000 lb. Boiler Unit

The 100,000 lb. per hour boiler unit in the J. I. Case Co. tractor works at Racine, Wisconsin, has demonstrated that it is one of the highest efficiency units in the United States. To obtain such high efficiency, careful tests of variable speed drives for fuel feed and grate travel were made during two years. Finally, Case engineers selected Oilgear Fluid Power Drives, for, as Mr. Cole H. Morrow, Chief Plant Engineer says, the Oilgear units proved far superior to electric drives and mechanical transmissions under actual operating conditions.

SMOOTH, POSITIVE SPEED VARIATION "In order to obtain high efficiency in any boiler unit," says Mr. Morrow, "*a very precise variable speed fuel feed drive* is required to meet widely varying demand. The Oilgear Drive gives smooth, positive variable speed operation from zero to 100% of capacity with a straight line fuel feed characteristic. This allows us to calibrate the control system for operation within amazingly close limits of fuel-air ratio variation.

EASE OF CONTROL "Also, on this type of stoker the grate speed must be infinitely variable from minimum to maximum yet maintained in direct proportion to the rate of fuel feed. Every change in fuel feed requires an immediate and directly proportionate change in grate speed. (Such synchronization) is easily obtained with the Oilgear drive units because of their ease of control, and the simplicity and low force requirements of the control mechanism."

UNLIMITED SPEED RANGE Also, fuel feed and grate drives must have a range of speed at least equal to the demand range. Most drives have a range not exceeding 4 to one. Yet at Racine, during the summer, demand drops far below the 25,000 lb. threshold imposed by such a ratio. The Oilgear Drives however have no "ratio" limits, would function down to zero load if necessary. In fact, they give precise load control down to a load of 15,000 pounds per hour normally obtained each day during the summer, and down to as low as 5,000 pph over the weekends still under full automatic control.

OUTSTANDING RELIABILITY "One of the outstanding features we discovered . . . was the *reliability of the Oilgear units*. The experimental installation operated almost continuously for a year and a half without any difficulty. This record was far better than we were able to obtain with any other type of drive or transmission."

These four features, variability, ease of synchronization and control, actual range from zero fpm, rpm or torque up to maximum, and reliability proven over and over again, are indications of the many advantages Oilgear drives and transmissions offer in machine design and use. Investigate Oilgear equipment as a *better* solution for your problems. THE OILGEAR COMPANY, 1564 West Pierce Street, Milwaukee 4, Wisconsin.

Oilgear

PIONEERS IN FLUID POWER
PUMPS, TRANSMISSIONS, CYLINDERS AND VALVES

USEFUL LITERATURE

You'll find many valuable production and design ideas in publications described here . . . copies will be sent you free without obligation

DIRECTIONAL CONTROL VALVES . . . built for pneumatic and hydraulic applications are illustrated in Ledeen Manufacturing Company's 16 page catalog. Described are hand, foot, power and solenoid operated valves. Dimensions and weights, application diagrams, circuit diagrams are clearly shown for each type of valve. All have rotating disc construction, chrome plated surface in body, integral disc and stem. The bulletin includes a parts and accessory list.

Circle 151 on Reader Service Card

GROMMETS . . . made in a wide range of proven rubber, synthetic rubber and silicone rubber compounds are listed in a 16 page file folder released by Goshen Rubber Co., Inc. The line includes the complete Air Force-Navy Standard AN931 grommet series, 34 basic sizes, each size available with 1/16, 1/8, 3/16 and 1/4 inch groove width, and the 34 sizes in the web type with 1/16 inch groove width. In addition there are many special sizes, all of which can be furnished from industrial compounds.

Circle 152 on Reader Service Card

OIL TEMPERATURE REGULATORS . . . are covered in a 12 page catalog, showing the whys and hows of temperature ranges and installation musts. Published by Lawler Automatic Controls, Inc., the catalog explains where and when to use direct acting, reverse acting, three way type thermostatic temperature regulators and lists typical engineering specifications. Illustrated with cutaway photos, diagrams, installation diagrams and engineering tables, the bulletin also details special product features.

Circle 153 on Reader Service Card

AIRCRAFT HYDRAULIC FLUID . . . its advantages, properties and conversion costs, are discussed in a new 16 page revised booklet. This publication, prepared by Monsanto Chemical Company's Organic Chemicals Division, states that present systems can be converted readily to fire-resistant Skydrol by a minimum of aircraft processing and material changes. The booklet also includes a sample itemized tabulation of man-hours required for conversion at either the 8,000-hour overhaul or pattern overhaul period.

Circle 154 on Reader Service Card

LEVEL INDICATOR . . . for application with most non-adhesive chemicals, oils, is the subject of a leaflet offered by Thermo Instrument Co. This meter-indicating level monitor derives its signal from an inert capacitive-type sensing probe. Specifications show that the instrument can be operated from high vacuum to pressures as high as 100,000 psi. Data included illustrates uses of the unit in remote indicating applications where the repeat meter can be located at a practically unlimited distance from the main sensing installation.

Circle 155 on Reader Service Card

HEAT EXCHANGERS . . . of the "F" shell and tube type, made by Young Radiator Company, are described in their new catalog No. 1245. This 12 page, two color, brochure contains application photographs covering a wide range of industries, presents materials, construction features, dimension drawings and tables. Four pages of the catalog are devoted to a simple, complete guide to heat exchanger selection. This data includes all necessary tables and formulas for selecting exchangers involving the most common cases of water-to-water and water-to-oil heat transfer.

Circle 156 on Reader Service Card

BALL BEARING SWIVEL FITTINGS . . . which range in size from 3/8 to 1 inch and from working pressures of 6,000 psi at 225 degrees F to 1,250 psi at 750 degrees F, are outlined in a bulletin issued by Emsco Manufacturing Company. Covering the HP and HT types, the literature describes method of construction and application of these fittings. Illustrated with many sectional drawings, it gives complete dimensions, specifications, weights and engineering data.

Circle 157 on Reader Service Card

For more reviews of Free Literature turn to page 122

Circle 39 on Reader Service Card ⟶

PIONEERS IN POWER STEERING

...TURN TO Eastman

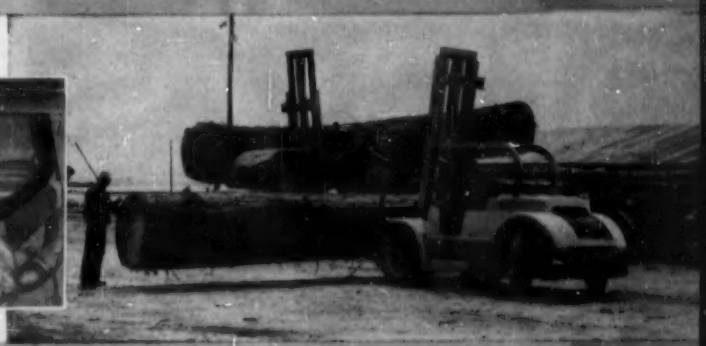
PIONEERS IN THE FIELD OF HYDRAULIC HOSE ASSEMBLIES

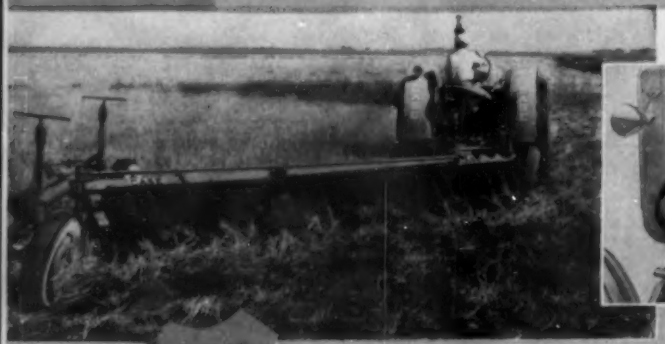
MOVING MOUNTAINS

Designers of this great mountain mover were pioneers in the application of hydraulic power in steering this type of earth moving equipment. Thus, *pioneers in power steering turned to pioneers in Hydraulic Hose Assemblies.* Hydraulic power—applied through Eastman Hydraulic Hose Assemblies to the twin brakes, shown here, wheel this International Model 75 "PAYSCRAPER" over rugged mountain terrain.

MOVING FORESTS

Eastman Hydraulic Hose, operating at 2000 lbs. p.s.i., delivers the power required to steer the rear axle, weighing 11,800 lbs., on this New "Hyster" SC-180 model. Due to heavy, load-balancing counter-weight over this axle, it would be impossible to steer this "King of the Lift Trucks" without hydraulic power when empty. Maximum maneuverability is attained through power steering—moving loads up to 9 tons, like these giants of the forest.





MOVING FIELDS

First tractor to use power steering—the Case "500" Diesel, at work here, uses Eastman "first in the field" Hydraulic Hose Assemblies for 1800 lbs. p.s.i. working pressure. Despite front end weight of 2470 lbs., hydraulic power makes steering almost effortless. Turning over 30 furrows in one "swath," this Case Disc Plow makes fields "move over" 18 feet at a time! Again, J. I. Case, *pioneers in farm machinery* since 1847, chose Eastman, *pioneers in Hydraulic Hose Assemblies.*

SAFEGUARDING INDUSTRY'S *Lifelines of Mobile Power*

Eastman
first in the field
MANUFACTURING COMPANY
Dept. AH-11, Manitowoc, Wis.

NOTE:
If you wish to be first in your field—come to Eastman—"first in the field" of Hydraulic Hose Assemblies.

WRITE for Catalog 101 on
Eastman Hydraulic Hose Assemblies

Hydraulics for

The Dowty organisation pioneered hydraulic power application for the aircraft and mining industries, and now the development of a range of high pressure gear pumps has rendered this versatile form of power more accessible to the wide fields of industry.

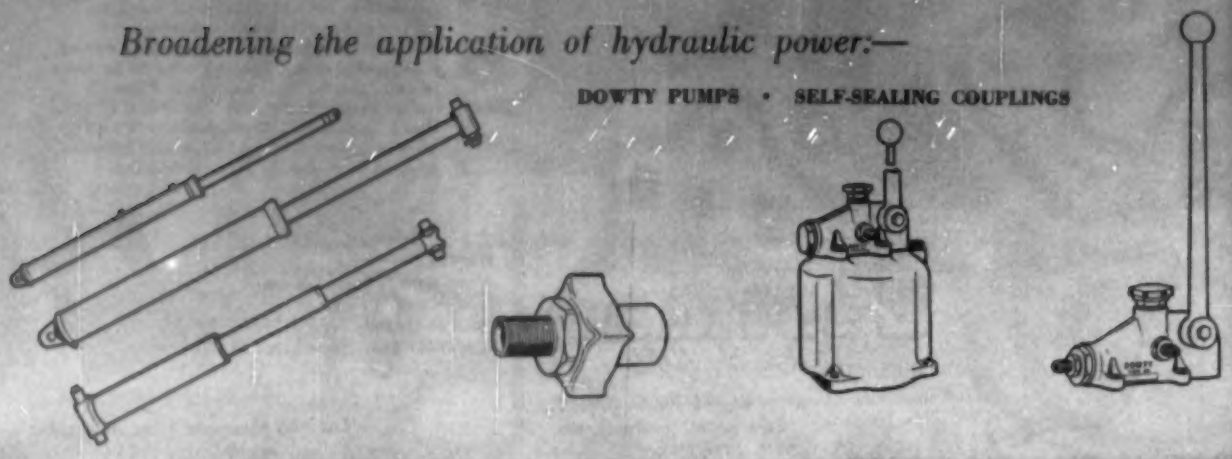
British designed, with British and overseas patents pending, the Dowty pressure balanced gear pumps provide the vital source of power for hydraulic actuation at low cost.

- **RANGE OF SIZES—CAPACITIES FROM 1 to 50 galls./min.**
- **PRESSURES UP TO 2,000 lb./sq.in.**
- **VOLUMETRIC EFFICIENCY UP TO 94%.**

DOWTY PRESSURE BALANCED GEAR PUMPS

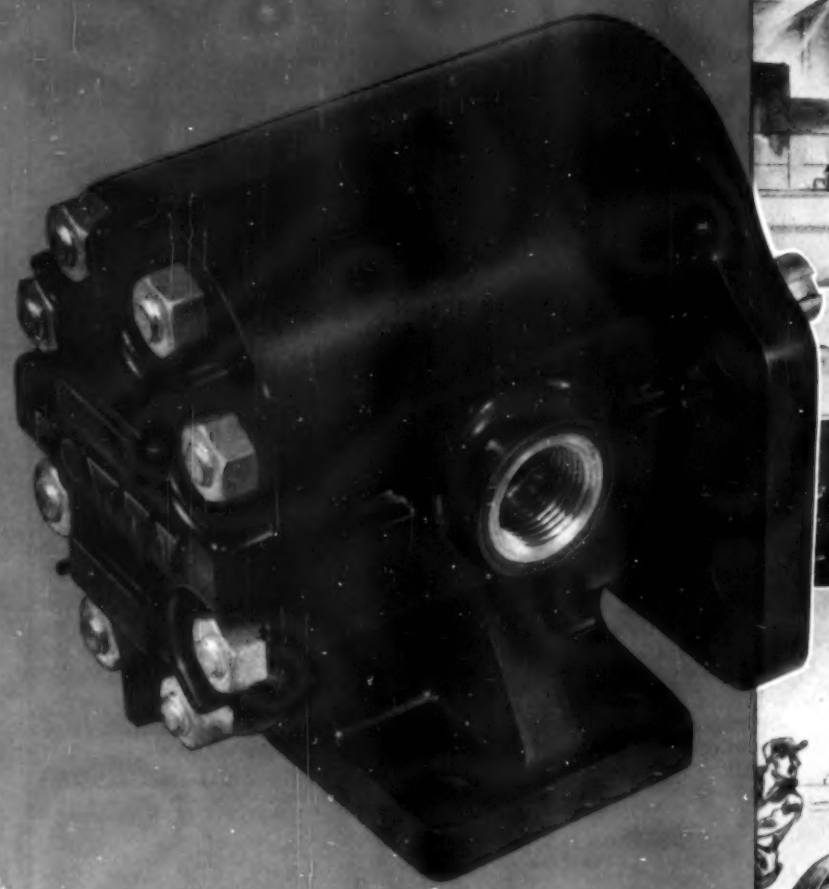
Broadening the application of hydraulic power:—

DOWTY PUMPS • SELF-SEALING COUPLINGS

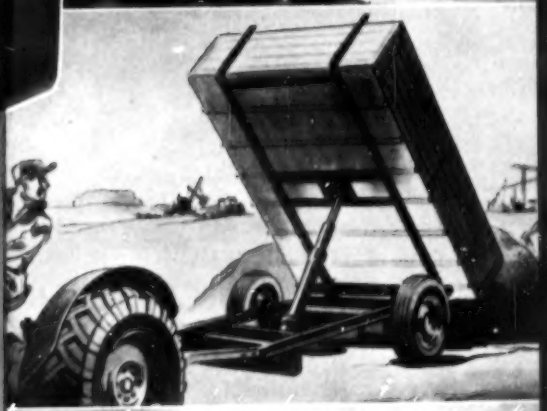


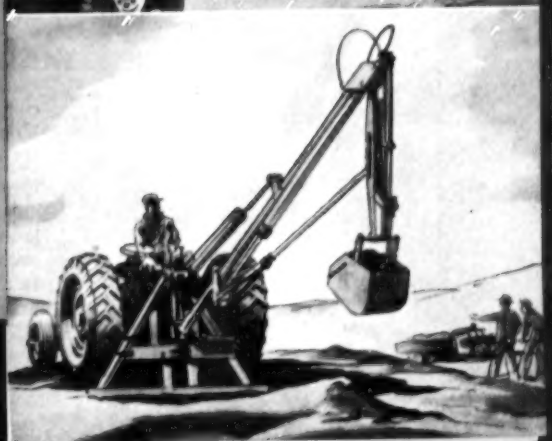
DOWTY HYDRAULIC UNITS LTD ASHCHURCH

Industry



CONTROL VALVES • HYDRAULIC CYLINDERS





GLOS · ENGLAND

Member of the DOWTY Group

NEW PRODUCTS

Components, tools and equipment designed to improve operation of fluid power systems are described here . . . for more information fill in and mail the post card bound in this issue.

HYDRAULIC MOTOR
. . . has high speed output

Design: A radial type motor, it has no valves to cause trouble as each piston acts as a valve for the adjacent cylinder. Anti-friction bearings are used throughout, a special shaft seal developed for this motor eliminates leakage at this point. The motor will run in either direction, will reverse instantly, and has almost constant torque over the entire speed range.

Specifications: Operating between 1000 and 1700 psi input, the motor turns up 5000 rpm at 1700 psi input with a power rating at this speed of 2.9 hp. The motor is 4¾ inches in diameter x 4 7/32 inches in length, weighs 3 lbs 11 oz.

Applications: Suitable for use with all commercial hydraulic fluids having a mineral base.

Sierra Engineering Company
Sierra Madre, California

Circle 201 on Reader Service Card

DOUBLE SOLENOID VALVE
. . . eliminates holding relays

Designation: Speed King

Features: This pilot operated control valve is used where momentary energizing of the solenoid is desired to reverse the position of the main stem. Both pilots are normally open, a reversal is accomplished by exhausting air on one end of the stem or the other. The valve is compact, overall dimensions approx. 3x5x8. Junction box optional. Valve is interchangeable with sub base used on present single solenoid valve. Each pilot solenoid has separate plunger.

Specifications: Available in both foot and manifold mounting in the basic ⅜ and ¾ inch sizes and in the 4-way body. External pilot supply optional.

Valvair Corporation
Akron, Ohio

Circle 202 on Reader Service Card

CONNECTOR AND AUTOMATIC VALVE
. . . for air or liquid testing

Designation: Connecto-Valve

Construction: Corrosion resistant materials used on valve body and component parts are designed for long service. Neoprene seals are readily replaceable.

Operation: Inserting this valve into an opening and depressing the cam lever simultaneously expands the connecting seal and opens the valve, effecting a leak-proof seal and releasing a full flow of air or liquid into the vessel or assembly under test. Withdrawal of unit automatically closes the valve.

Specifications: Inlet connections are tapped into valve body for ⅜ pipe pressure lines. Valves are available from stock for sealing ½, ¾ and 1 inch pipe openings.

Applications: A quick-connect method for sealing air or liquid pressure lines for standard openings of testing vessels, appliances, systems or assemblies.

Mechanical Products Corporation
Chicago, Illinois

Circle 203 on Reader Service Card

SUMP TYPE (Cutaway)

For Dependable Protection on your HYDRAULIC EQUIPMENT

MARVEL SYNCLINAL FILTERS

LINE TYPE (Cutaway)

Hydraulic Oils MUST BE CLEAN!

to Protect Equipment—
Increase Production—
Reduce Maintenance

PRODUCTION ENGINEERS and MAINTENANCE MEN, whose job it is to keep production machinery operating at peak efficiency, are specifying Marvel Synclinal on new equipment and standardizing with Marvels throughout their plants.

OVER 500 ORIGINAL EQUIPMENT MANUFACTURERS of hydraulically actuated equipment or machines utilizing low pressure liquid circulating systems, also recognize the superiority of Marvel Synclinal Filters in serving this purpose and are installing them as standard equipment.

It's The ACTIVE Filtering Area That Counts!

The Synclinal design of Marvel Filters provides that all-important balance between maximum ACTIVE filtering area and sufficient storage capacity for filtered out particles. Thus, longer periods of productive operation are attained before filter cleaning is necessary. Marvel Synclinal Filters are easy to clean because both the sump and line type may be disassembled, thoroughly cleaned and reassembled in a matter of minutes. Line type operates in any position and may be serviced without disturbing pipe connections.

A SIZE FOR EVERY NEED

Available for sump or line installation in capacities from 5 to 100 G. P. M. Greater capacities may be attained by multiple installation (as described in catalog). Choice of monel mesh sizes range from coarse 30 to fine 200.

WATER FILTERS

Both sump and line type filters have been adapted for use in all water filtering applications. No changes have been made in the basic, balanced synclinal design.

IMMEDIATE DELIVERY

As in the past, Marvel continues to offer IMMEDIATE DELIVERY.

FILTERS FOR NON-FLAMMABLE HYDRAULIC FLUIDS

Marvels most recent development is a filter for the efficient filtration of all types of non-flammable hydraulic fluids.

Catalogs containing complete data available on request

MARVEL ENGINEERING CO.
625 W. JACKSON BLVD., CHICAGO 6, ILL.
PHONE: FRANKLIN 2-4431 & FRANKLIN 2-3530

Without obligation, please send me complete data on Marvel Synclinal Filters as follows:

Catalog No. 106 for Hydraulic Oils, Coolants, Lubricants
Catalog No. 300 for Water
Data on filters for non-flammable hydraulic fluids

AH-11

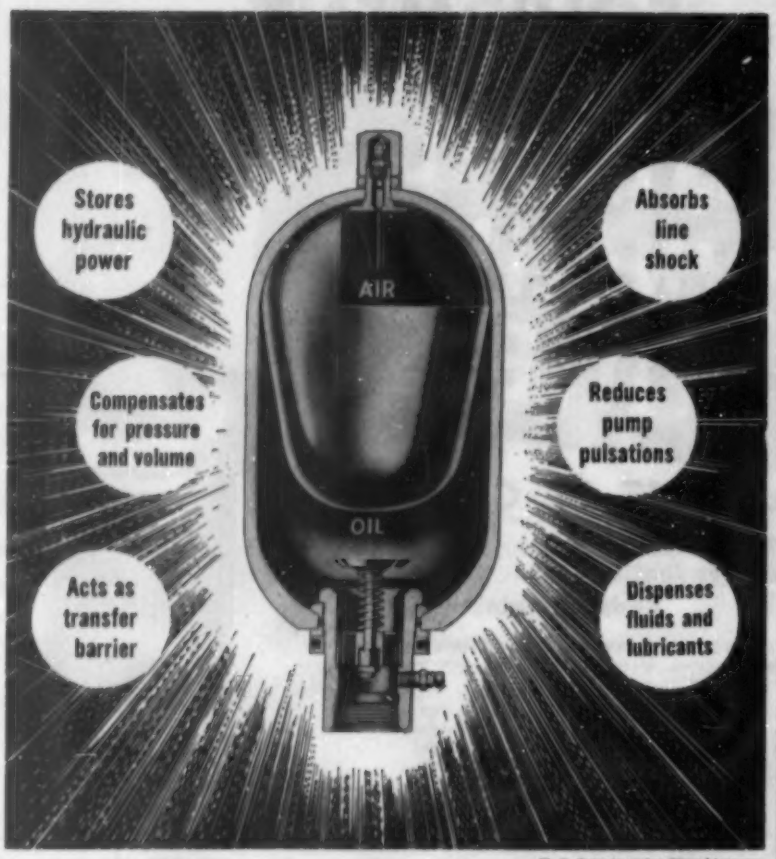
Name _____ Title _____

Company _____

Address _____

City _____ State _____

MOST VERSATILE HYDRAULIC COMPONENT EVER DEVISED!



U. S. Patents under Olaer Licenses

The Greer Accumulator

Today, Greer Accumulators are at work in almost every industry you can name. They are found in the hydraulic systems of buses, construction machines, ships, planes, submarines, and flying missiles. They power all types of presses, control steel processes, operate electric switches, absorb pulsations in oil pipelines—to mention a few of hundreds of applications.

Greer Accumulators can reduce the cost, size, weight, and complexity of your machines and equipment. And Greer's experienced application engineers know where accumulators belong *for* use, maximum performance and *complete* safety. Let them help you solve your hydraulic problem. Write or call Greer. No obligation. Brochure 301-A gives technical data on the Greer Accumulator. Ask for your free copy today.

GREER HYDRAULICS INC. • International Airport • JAMAICA 30, NEW YORK

Field offices in Chicago, Dayton and Detroit • Sales Representatives in all principal cities

New Products

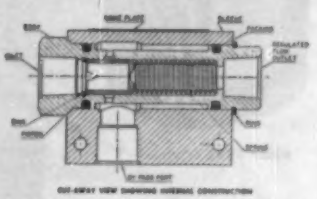
Continued

FLOW REGULATOR
. . . features automatic by-pass

Designation: Model 1801 Series

Construction: Aluminum bodies and pistons, steel sleeves and stainless steel precision calibrated springs.

Features: Maintains constant rate of flow regardless of variation in pressure or back pressure while simultaneously by-passing excess pump output at working pressure. Oil flow from by-pass port can be directed to additional bypass regulators or to



secondary circuits without effecting the regulation of initial unit.

Applications: For fluid motors, or any hydraulic system requiring a constant flow rate less than pump output.

Specifications: ⅜ inch pipe size, controlled flow 0.3-6.0 gpm, by-pass flow 0-12 gpm; ½ inch pipe size, controlled flow 1.0-12.0 gpm, by-pass flow 0-20 gpm; 3000 psi.

Waterman Engineering Company
Evanston, Illinois

Circle 204 on Reader Service Card

VARIABLE DELIVERY PUMPS
. . . with integral controls

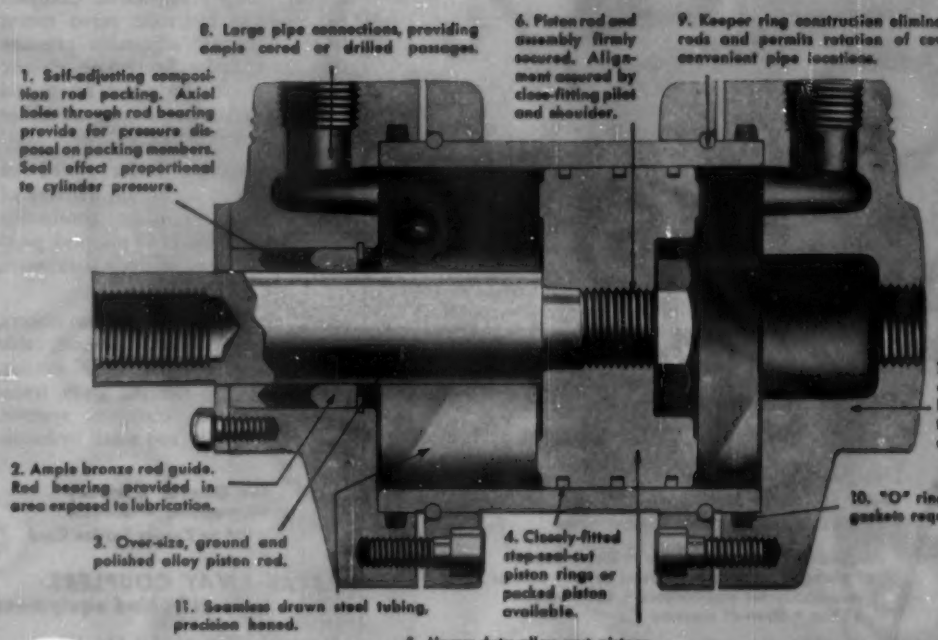
Designation: Type AS-311 Two-way variable delivery pump

Construction: Each pump is a complete package unit incorporating a variable delivery high pressure radial

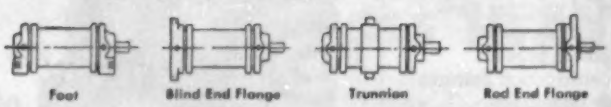
piston pump, a constant delivery, low pressure gear pump, one of eight standard controls, a three way suction and return valve for differential

Continued on page 40

More Power to You


8. Large pipe connections, providing ample cored or drilled passages.
6. Piston rod end assembly firmly secured. Alignment assured by close-fitting pilot and shoulder.
9. Keeper ring construction eliminates tie rods and permits rotation of covers to convenient pipe locations.
1. Self-adjusting composition rod packing. Axial holes through rod bearing provide for pressure disposal on packing members. Seal effect proportional to cylinder pressure.
7. Heavy-duty alloy covers, bored to fit a turned diameter on tube.
2. Ample bronze rod guide. Rod bearing provided in area exposed to lubrication.
10. "O" ring seals. No gaskets required.
3. Over-size, ground and polished alloy piston rod.
4. Closely-fitted step-seal-cut piston rings or packed piston available.
11. Seamless drawn steel tubing, precision honed.
5. Heavy-duty alloy cast piston with large bearing surfaces.

SEVEN STANDARD MOUNTINGS



..with RIVETT HYDRAULIC CYLINDERS

You'll find the performance of Rivett hydraulic cylinders close to foolproof. Designed with the utmost simplicity, they have no tie rods — keeper ring design permits covers to be rotated to convenient pipe connections and installation made in a minimum of space. External "O" rings are used as static seals to eliminate gaskets and assure leakproof operation. Sealing efficiency improves with increased pressure. Closely fitted automotive type piston rings reduce friction to a minimum.

Available in three pressure ranges: to 300 P.S.I. maximum and 1500 P.S.I. maximum service with standard models. 3000 P.S.I. maximum and higher services furnished on application. Seven standard mountings, in 10 bore diameters, in any stroke up to 96", with standard size or 2:1 over-size piston rods, cushioned rod end, blind end or both. Special covers supplied. Send for Catalog Section 106.

RIVETT LATHE & GRINDER, Inc.
DEPT. AH-11, BRIGHTON 35, BOSTON, MASSACHUSETTS

RIVETT furnishes a complete power package

VALVES • CYLINDERS • POWER UNITS
Air and Hydraulic
All sizes and types

BY ANY STANDARD...

ADEL *Refinements* assure Plus Performance for Your Equipment

Designers and Engineers have set these standards for Industrial Hydraulic Equipment

Rugged simplicity • Long life • Simplification of piping • Reduced installation costs • Greater accessibility for maintenance • Completeness of line • Over-all economy

ADEL brings them all to you!

Smooth economical hydraulic power for Pushing, Pulling, Lifting, Pressing, Clamping and Controlling.

Illustrated are but a few of a wide variety of ADEL industrial hydraulic control equipment that offer definite benefits to both the user and builder of machine tools and many other kinds of equipment. ADEL products incorporate proven design and precision construction features that assure dependable operating efficiency over the years. A complete line for every application. You can simplify your Hydraulic Power Motion Problems by specifying ADEL.

A FEW SELECT TERRITORIES ARE STILL AVAILABLE TO PROGRESSIVE DISTRIBUTORS OF INDUSTRIAL HYDRAULIC CONTROL EQUIPMENT. INQUIRIES INVITED.

For complete engineering specifications and counsel, Address: ADEL DIVISION, GENERAL METALS CORPORATION, 10771 Van Owen Street, Burbank, California

ADEL LEADER IN HYDRAULICS

DIVISION OF GENERAL METALS CORPORATION • Burbank, Calif.

Manufacturers of Industrial Hydraulic Control Equipment

DISTRIBUTORS: AIR & HYDRAULIC ENGINEERING CO., NEW HAVEN, CONN. • RUSS CHAMBERLIN COMPANY, PORTLAND, OREGON • J. BOYD COATES, PHILADELPHIA, PA. • FRANK T. DONNELLY COMPANY, PITTSBURGH, PA. HASKEL ENGINEERING & SUPPLY CO., SAN FRANCISCO, CALIF. • HASKEL ENGINEERING & SUPPLY CO., GLENDALE, CALIF. • HYDRAULIC BRAKE SUPPLY CO., PHOENIX, ARIZ. • LINCOLN SUPPLY CO., PROVIDENCE, R. I. • SCOTT EQUIPMENT AND ENGINEERING COMPANY, DAYTON, OHIO • H. F. SODERLING CO., SEATTLE, WASH. • ROBERT TAYLOR & SONS, SALT LAKE CITY, UTAH • WYATT SALES COMPANY, CLEVELAND, OHIO • CORBY SUPPLY COMPANY, ST. LOUIS, MO. • INDUSTRIAL AIR & HYDRAULIC EQUIPMENT CO., DETROIT, MICH. • HYDRAQUIP CORPORATION, HOUSTON, TEX.

New Products

Continued

systems, dual disk type check valves for non-differential systems, a double acting high pressure relief valve and a gear pump relief valve. Compact hand screw, hydraulic servo motor lever, automatic adjustable pressure unloading, hydraulic remote, electric remote, electric-hydraulic servo and pneumatics control mount on either side of the pump case.

Specifications: Drive speed of 1450 rpm has maximum delivery of 930 cipm, maximum continuous working pressure 1140 psi, peak pressure 10 per cent of cycle maximum, 1350 psi.

Applications: For use on stokers, paper cutters, forging machines, cable wrappers, winders, extruders, cutters, conveyors, ship steering gears, transfer mechanisms, clamping systems, boring machines and small hydraulic presses.

The Oilgear Company
Milwaukee, Wisconsin
Circle 205 on Reader Service Card

BREAK-AWAY COUPLERS ... for pull behind equipment

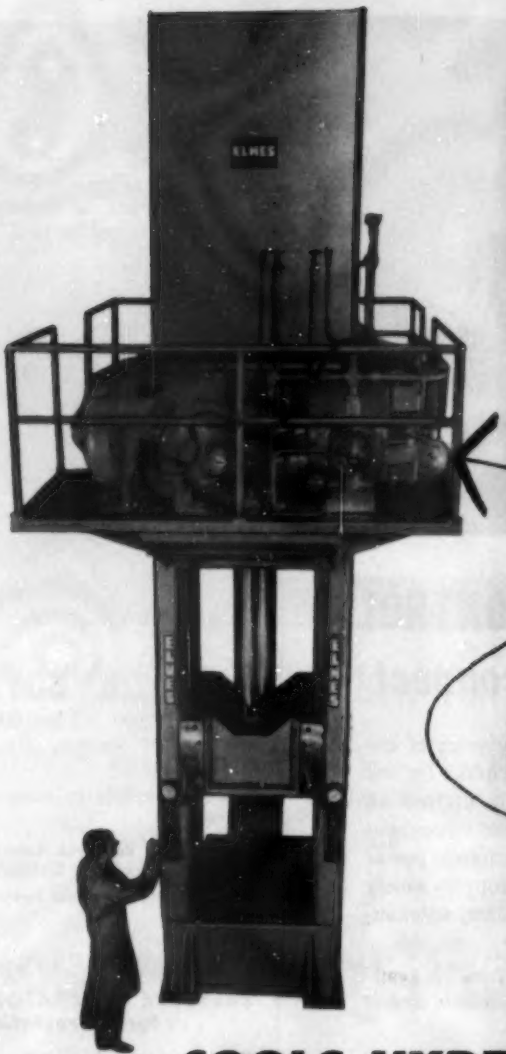
Designation: Model 112 KS
Design: A new break-away coupler, couples with full pressure on both sides of the line. It has a positive

break-away action, withstands hard usage, and is designed to meet equipment manufacturers requirements. Uses nylon valve seats to insure positive self sealing on break-away. It can be mounted individually or in tandem.

Dukes Company, Inc.,
Chicago 14, Illinois
Circle 206 on Reader Service Card

STAINLESS STEEL FITTINGS ... for high pressure service

Features: Made by the centrifugal casting method, tubing, bar stock and forging dies are not needed for these



ROSS EXCHANGER

COOLS HYDRAULIC OIL

to keep this 200-ton Elmes Drawing Press operating at peak efficiency

Neatly mounted at the crown of this 200-ton Elmes Drawing Press, a compact Ross Type BCF Exchanger plays an important role. It maintains correct hydraulic oil temperature. Pump slippage from overheated, thinned oil is prevented. Peak press efficiency is thereby insured for all types of deep drawing and forming operations.

"Ross Coolers are used extensively on Elmes Hydraulic Presses. They are chosen for their high efficiency, compactness and ease of installation. We find they stand up well under pressure surges and require no upkeep," reports Elmes Engineering Division, American Steel Foundries.

Favored for numerous types and makes of hydraulic machinery, rugged Ross Type BCF Exchangers are pre-engineered, fully standardized and stocked in a wide range of sizes to meet most needs . . . promptly.

For more information, request Bulletin 1.1K5.

KEWANEE-ROSS CORPORATION
DIVISION OF AMERICAN RADIATOR & STANDARD SANITARY CORPORATION
1464 WEST AVENUE • BUFFALO 13, N. Y.
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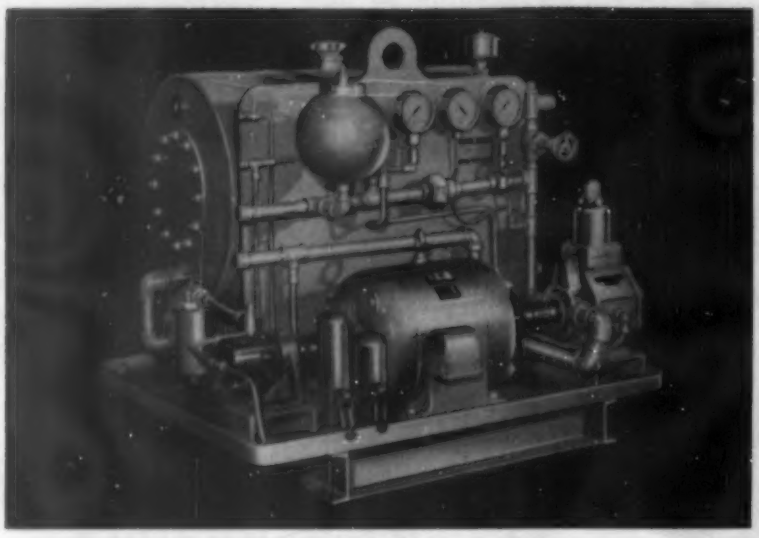
ROSS EXCHANGERS

Serving home and industry: AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS • SUNBEAM AIR CONDITIONERS



Complete POWER and CONTROL SYSTEMS... *ready to connect*

SIMPLEX Engineering Company has many years of experience in co-ordinating the hydraulic principles, for all industrial applications. We have always freely utilized all types and makes of hydraulic equipment available throughout the industry. Our ability to design and build hydraulic power units of every description has enabled us to thoroughly satisfy all customer requirements, regardless of pressures, volumes, or circuits.

This vast background of hydraulic "know how" is available to all SECO *customers. We invite you to outline to us any special project.*

STANDARD *Power Package Units*

SECO

We build 26 *standard* power package units —suitable for a wide range of requirements, and ready to connect to the press or other mechanism to be operated. These *standard* units provide volumes of ½ to 10 G.P.M., and pressures from 500 to 10,000 PSI. Use the coupon below for complete information on these *standard* power and control units.

SIMPLEX ENGINEERING CO.
Zanesville, Ohio

Please send me complete information on SECO Standard power package units.

Name_____ Title_____

Company_____

Address_____

Circle 106 on Reader Service Card

New Products

Continued

stainless steel fittings. The fittings appear to be of greater strength. Tests subjecting them to hydraulic pressures of 12,000 psi for an 8-hour peri-

od showed absolutely no leakage or seepage. Further tests increased pressures to 22,500 psi, but fittings held up without leakage, distortion or damage.

Sizes: Available in many sizes and shapes.

Industrial Research Laboratories
Los Angeles, California

Circle 207 on Reader Service Card

PRESSURE GENERATOR ... for hydrostatic testing

Designation: Type E Continuous Intensifier

Features: A completely self contained pressure generator employing an oil-hydraulic pump circuit to produce intensified high pressure water or other fluid. The volume and pressure are easily adjusted within the range of the unit and pressure application is smooth, non-pulsating, and surge free.

Specifications: Capacities to 18 gpm and 12,000 psi; larger volumes at lower pressures. Because of their size and range, these machines are built on order to meet the needs of given applications.

Benjamin Lassman & Son
Glenshaw, Pa.

Circle 208 on Reader Service Card

For more NEW PRODUCT reviews turn to page 106

* Weatherhead Ermeto Connectors serve lubrication and injection systems on this 3440 h.p. Nordberg diesel engine at working pressures up to 9000 psi

ERMETO®

Do You Get All This When You Buy Hydraulic Connectors?

- ☐ FIELD ENGINEERING SERVICE?
- ☐ SIMPLIFIED ORDERING AND INVENTORY?
- ☐ PROGRESSIVE PRODUCT DESIGN?
- ☐ QUALITY MATERIALS AND MANUFACTURE?

* those who buy WEATHERHEAD do!

Ermeto®—the original flareless fitting—provides a positive, leakproof, vibration-resistant seal at any pressure. Because there's no flaring, threading, welding or soldering, you can make an Ermeto connection in 30 seconds with a wrench as your only tool.

With the patented Ermeto design, a case-hardened sleeve actually shears a groove into the outer surface of the tube and bows when the nut is tightened. This cutting and bowing action assures a positive seal; yet a joint has been made that you can disassemble and reassemble over and over again.

Designed for high-pressure use, Ermeto has simplified tube connections and cuts costs so successfully that many companies standardize on Ermeto for all joints, thus reducing inventory problems. Ermeto is made in steel, stainless steel and Monel, ⅛" to 2" I. Diam. Weatherhead field engineers can provide detailed data and counsel on applications. Or write for Ermeto Catalog E-1457. The Weatherhead Company, Dept. A, 300 East 131st Street, Cleveland 8, Ohio.

YOU'RE AHEAD WHEN YOU SPECIFY . . .

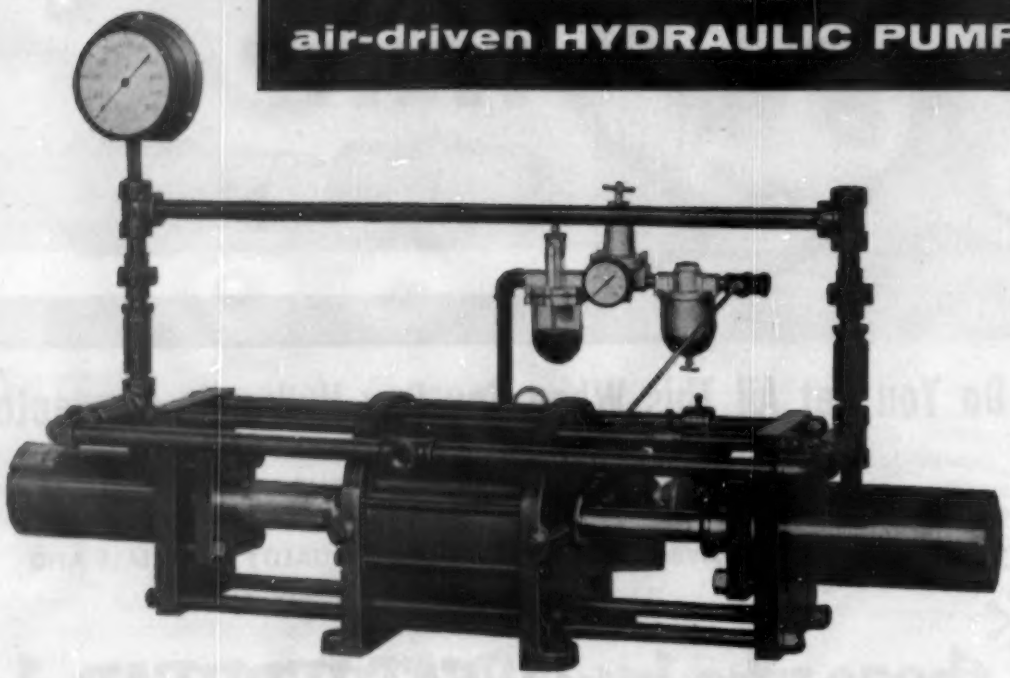
WEATHERHEAD

This trademark (W) appears on every make of car, truck, bus, and tractor (W) on equipment for machine tools, diesel and hydraulic applications (W) on equipment for instrumentation, oil drilling, mining, road building (W) for aircraft, railway, and marine engines (W) for LP-Gas and anhydrous ammonia control equipment (W) this symbol represents more than 1800 products made by Weatherhead . . .

new!

ALDRICH

air-driven HYDRAULIC PUMP



. . . *for small volume capacity at low or high pressures*

Here is a new pump that will develop up to 30,000 psi from ordinary 90 psi plant air—without auxiliary equipment! This air-driven hydraulic pump is self-contained, complete with regulator, air filter, lubricator and pressure gauge.

New design provides economy of operation for many industrial applications—

- *supplying power for molding and belt presses*
- *testing tubing, valves or pressure vessels*
- *ideal for laboratory as well as production use*
- *and for many other applications requiring small volume capacity at low or high pressures.*

Special muffler design provides quiet operation.

Aldrich Air-Driven Hydraulic Pumps are available in low and high pressure models, single or double-acting. Plunger diameters for the low pressure range are 1¼″ to 3″. High pressure range, ½″ to 1⅛″. Double-acting units provide minimum pressure fluctuations in addition to greater volumes.

Write for new Data Sheet 36 for complete details.

the ALDRICH *pump company*

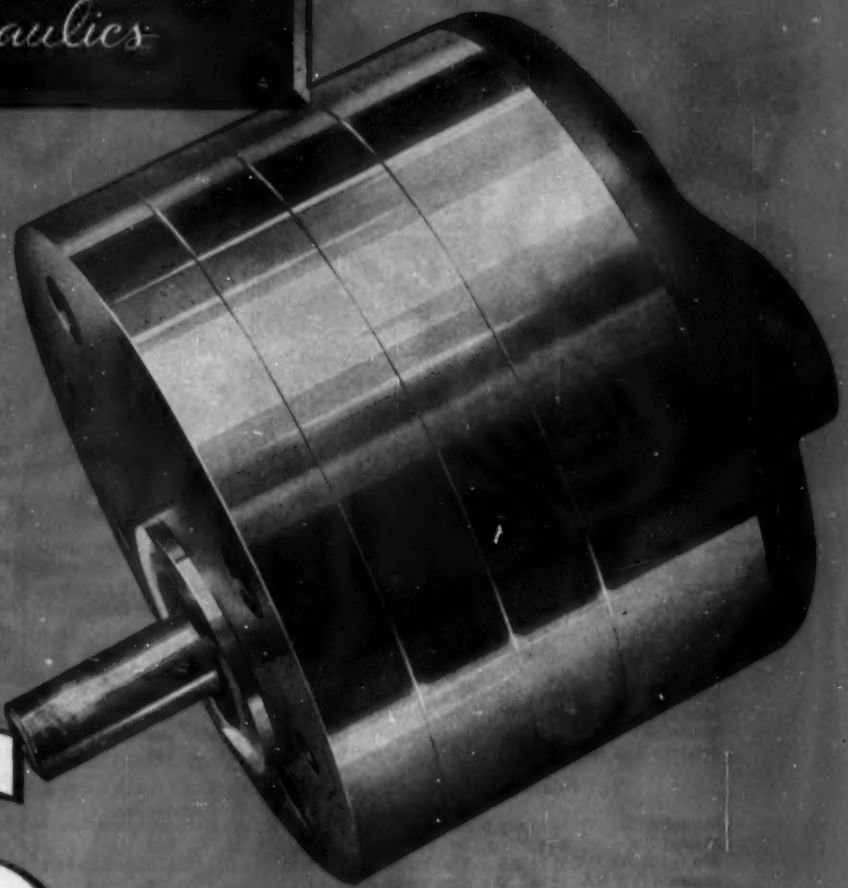
. . . Originators of the Direct Flow Pump

14 GORDON STREET • ALLENTOWN, PENNSYLVANIA

Representatives: Birmingham • Bolivar, N. Y. • Boston • Buffalo • Carmi, Illinois • Charleston, W. Va. • Chicago • Cincinnati • Cleveland • Dallas • Denver • Detroit • Duluth Houston • Los Angeles • New York • Oakland, Calif. • Philadelphia • Pittsburgh • Portland, Ore. • Richmond, Va. • Rochester • Salt Lake City • San Francisco • Seattle Somerville, Mass. • Spokane, Wash. • Syracuse • Tulsa • Washington, D. C. • Youngstown • Export: Petroleum Machinery Corp., 30 Rockefeller Plaza, New York 20, N. Y.

Circle 6 on Reader Service Card Circle 69 on Reader Service Card

Keelavite hydraulics



FROM 6 BASIC DESIGNS...

. . . a complete range of hydraulic power transmission units from fractional to 250 h.p.

PUMP/MOTOR UNITS • VALVES • POWER PACKS
CYLINDERS • TRANSMISSIONS • REMOTE CONTROLS

THE RECOGNISED AUTHORITY ON HYDRAULIC POWER TRANSMISSION

KEELAVITE ROTARY PUMPS & MOTORS LIMITED • ALLESLEY • COVENTRY • ENGLAND
TELEPHONE: MERIDEN 235-6

HOW TO PICK THE RIGHT PUMP FOR THE JOB

TUTHILL *Simplifies Pump Selection for PRODUCT DESIGNERS*

To make it easy for product designers to select the right oil pump for the job, Tuthill offers new catalog data covering pump models to meet the specific pumping purposes outlined below. Each catalog features an individual pump guide so you can select the exact pump to fit your need. Check the following services and ask for the Tuthill catalogs you wish by Catalog number indicated.

For PRESSURE LUBRICATION

		Catalog No.
Model L	⅛ to 6 g.p.m. up to 200 p.s.i.	101
Model C	2 to 200 g.p.m. up to 100 p.s.i.	102
Model R	¼ to 200 g.p.m. up to 100 p.s.i.	105
Models S & SA	⅓ to 200 g.p.m. up to 200 p.s.i.	106

For HYDRAULIC SERVICE

		Catalog No.
Model L	⅛ to 6 g.p.m. up to 600 p.s.i.	101
Model CK	5 to 200 g.p.m. up to 400 p.s.i.	103
Model R	¼ to 200 g.p.m. up to 400 p.s.i.	105
Models S & SA	⅓ to 200 g.p.m. up to 200 p.s.i.	106

For COOLANT SERVICE

		Catalog No.
Model C	2 to 200 g.p.m. up to 100 p.s.i.	102
Model CK	100 to 200 g.p.m. up to 200 p.s.i.	103
Model M	2 to 50 g.p.m. up to 15 p.s.i.	104
Model R	2 to 200 g.p.m. up to 100 p.s.i.	105
Models S & SA	2 to 200 g.p.m. up to 200 p.s.i.	106

For TRANSFER AND CIRCULATING

		Catalog No.
Model L	⅛ to 6 g.p.m. up to 200 p.s.i.	101
Model C	2 to 200 g.p.m. up to 100 p.s.i.	102
Model CK	100 to 200 g.p.m. up to 200 p.s.i.	103
Model R	2 to 200 g.p.m. up to 100 p.s.i.	105
Models S & SA	2 to 200 g.p.m. up to 100 p.s.i.	106

For BURNING OILS

		Catalog No.
Model L	⅛ to 6 g.p.m. up to 200 p.s.i.	101
Model C	2 to 50 g.p.m. up to 100 p.s.i.	102
Type SU	2 to 50 g.p.m. up to 300 p.s.i.	107

For BUILT-IN APPLICATIONS

All standard Tuthill Pump models are available in stripped form for building into the design of your equipment. Ask for Catalog No. 106.

TUTHILL PUMP COMPANY

Dependable Rotary Pumps since 1927

939 East 95th Street, Chicago 19, Illinois

Canadian Affiliate: Ingersoll Machine & Tool Co., Ltd. Ingersoll, Ontario, Canada

TUTHILL PUMPS FOR THE PURPOSE

Free Literature Offered In This Month's Ads

For more information circle numbers on the reader service card bound in this issue between pages 128 and 129.

New re-rated **motors** which save space and are easier to interchange, feature double-shielded bearings. They are described in a bulletin released by Howell Electric Motors Company.

Circle 60 on Reader Service Card

A twelve page brochure giving information on sizes, groove dimensions and application data of **O-rings**, is yours by writing to Goshen Rubber Co. Inc.

Circle 51 on Reader Service Card

Metallic rod wipers will protect your hydraulic seals, bearings, machine spindles. Request complete information from Hydraulic Accessories Co.

Circle 62 on Reader Service Card

Checking **pump** data available from American Engineering Company may help you solve a problem for a high pressure hydraulic pumping system.

Circle 9 on Reader Service Card

Single wall **steel tubing** which gives reliable performance is described in a catalog offered by Avon Tube Division of Higbie Manufacturing Co.

Circle 14 on Reader Service Card

Four mounting types are available for powerful single and double acting **air cylinders**. Air Mite Devices, Inc., will send you a complete catalog.

Circle 4 on Reader Service Card

Load weight controls rate of descent when using pressure operated hydraulic **flow control valves** on fork lift trucks. All details are available from Benton Harbor Engineering Works.

Circle 20 on Reader Service Card

If you want to pump large volumes of oil at high speeds, find out what **rotary-geared pumps** can do. Ask for Brown & Sharpe Mfg. Co.'s new pump catalog.

Circle 22 on Reader Service Card

ANCHOR

Clamp-Type, Reusable Coupling

Positive Grip — Easily Applied

...for hydraulic hose, ideal for both emergency field-repair service and original equipment application

Yes, here's a hydraulic hose coupling you can count on. It has a powerful grip and can be used with one- or two-wire braid hose for medium or high pressures, or fabric hose. Impulses can't shake it loose — yet it's reusable again and again, is put on or taken off quickly.

Because Anchor clamp-type couplings stay on the job, outlast the hose, hydraulic systems stay dependable, perform the way they were designed to perform.

Dependability isn't the only feature of this Anchor coupling... just look at these advantages:

Neat installation — made possible by compact design of the Anchor clamp and the use of streamlined Anchor adapter unions and related fittings.

Easy to apply — no special tools needed to attach or detach — just two automotive-type wrenches. And, it's unnecessary to strip the cover off the hose.

Built to take it — clamping segments are specially designed to give the extra strength needed in hydraulic service, insert stem machined from high-grade steel rod stock, bolts are heat-treated and all parts are rust proof.

Saves time — you don't have to wait for repairs because you can make up your hose lengths as needed. Stocking problem minimized.

This clamp-type coupling is widely used on equipment subjected to rough going. For example, many earthmoving and oil-field equipment manufacturers standardize on Anchor to assure maximum dependability under the toughest possible conditions. This is the coupling for you, too — the coupling with the grip that stops complaints. Write today for catalog of sheets giving size tables and recommended working pressures.

ANCHOR COUPLING CO. INC.

Main Office and Factory • LIBERTYVILLE, ILLINOIS

Factory Branches:

277 Amelia Street, Plymouth, Michigan (In the Greater Detroit Area)

2100 Irving Boulevard, Dallas, Texas

Assembly is quick and easy, the grip firm and strong. No special tools needed.

Attach this Coupon to your Letterhead and Mail Today!

ANCHOR COUPLING CO. INC.
Dept. AH-11, Libertyville, Illinois

I want to know more about your clamp-type coupling that is so dependable and easy to use. Please send me catalog sheets.

Name.....Position.....

Company.....

Company Address.....

City.....(.....) State.....

D-8

Series 100 Open Motors are lighter in weight and take up to 30% less space than open motors of old NEMA frame sizes.

Series 100 TEFC Motors have same diameters as the Series 100 Open Motors, for easier interchangeability.

New Howell Series 100 open and TEFC motors have same diameters!

Howell's new re-rated motors save space, are easier to interchange! Feature double-shielded bearings . . . serve your needs better *all* ways.

If space ever limited your use of motors, here's welcome news: Series 100 Open and TEFC Motors have the same diameters! The reason? – Howell's exclusive ventilating system. This system cools *internally* providing 50% more contact between cooling air and active lamination materials. Result: you get motors that meet minimum space requirements . . . that run cooler than established ratings . . . that have increased load capacities – you get improved performance and longer life!

Less maintenance, too! New double-shielded bearings are standard on both the open and TEFC motors. These bearings seal grease in – dirt out. And where operating conditions are severe, you can re-grease them quickly, easily. Actual use proves these double-shielded bearings best for most applications; however, any type can be furnished.

Meet your special needs! New Series 100 Motors provide dependable copper rotors – three diameters for each frame size to assure design flexibility. Special corrosion-resistant materials and fittings are available.

Before you buy any re-rated motor, compare Howell's Series 100 Motors -- for modern design, outstanding performance and precision engineering. Howell will continue to make a complete line of regular and special motors—with over 20,000 electrical design specifications to serve you. Call your Howell man today or write for Bulletin N-100!

HOWELL Red Band MOTORS

HOWELL MOTORS

Howell Electric Motors Company, Howell, Michigan

MOTORS FOR INDUSTRY SINCE 1915

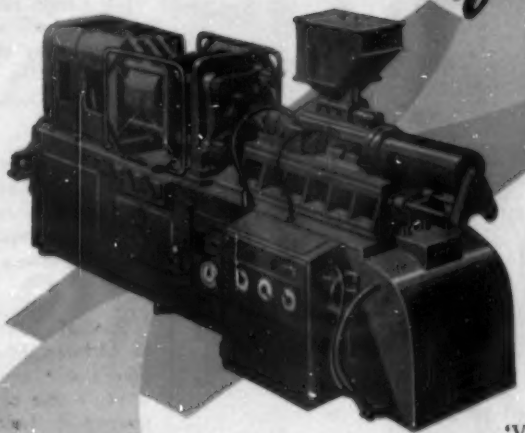
SERVING MODERN INDUSTRY

'VSG'

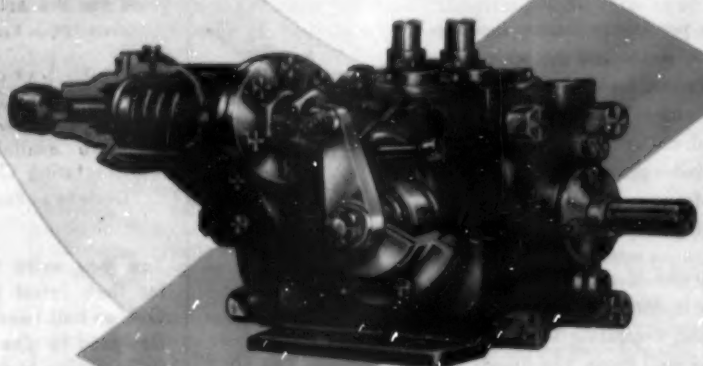
Regd Trade Mark

Infinitely VARIABLE DELIVERY PUMPS

The WINDSOR
SH 8/10
Plastic Injection
Molding Machine



'VSG' Auto Pumps are ideal for Injection Molding Machines, the Windsor 10 oz. Machine being a typical example. Standard 'VSG' Pumps and Variable Speed Transmission Gears are available for early delivery. Pump capacities 0-400 gal. per min.: pressure ranges 1,000, 2,000 and 3,000 p.s.i. *Further details will be sent on request.*



'VSG' Variable Delivery Axial Piston Type Pump with Automatic Pressure Control

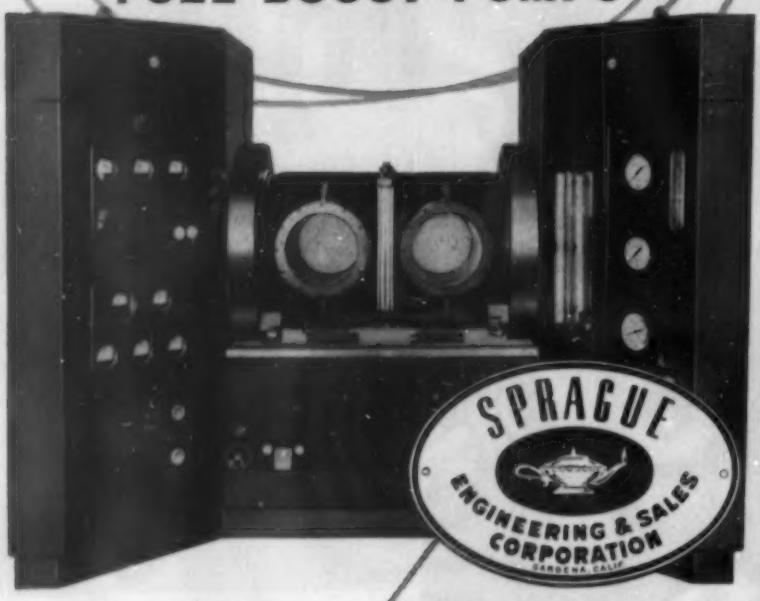
VICKERS-ARMSTRONGS LTD

VICKERS HOUSE · BROADWAY · LONDON · ENGLAND *Cables* **VICASTRONG LONDON**

AGENTS IN CANADA: EAST: Consolidated Engines & Machinery Co., Ltd., 5645 Pare, Montreal, Quebec and 14th & Birmingham Streets, New Toronto, Ontario. WEST: Galbraith & Salley Ltd., 1331 West 6th Avenue, Vancouver 9.

P13a

TESTER
for submerged
FUEL BOOST PUMPS



MODEL S-527 is a complete and comprehensive machine for all-inclusive testing of every type of electrically driven submerged fuel boost pump in current use. Pumps are placed in power operated, fluid-filled, rotating tank for testing in every flight attitude. Windows permit inspection during tests.

Two mounting pads are provided on rotating tank permitting one pump to be run-in and the other to be tested. Either pad may be used for test by a push-button operated pneumatic selector valve system. 45,000 pph. flow range. 28 vdc and 400 cycle ac instrumentation and power supply. Explosion proof. Drip-tray and cabinet force-ventilated. Measures 108" wide, 60" deep, 84" high. Write today for complete information.

THE MODEL S-527 is but one of many specialized test benches made by Sprague. Others include Hydraulic Test Machines, Pressurized Cabin Leakage Testers, Heating and Ventilating Test Units, Air Operated Oil Dispensers, Fuel Flow and Fuel Pump Test Stands and other Aircraft Test Equipment. Write for Bulletins.

SPRAGUE
Engineering and Sales Corp.
1144 WEST 135TH STREET, GARDENA, CALIFORNIA

Free Literature Offered in this Month's Ads

Continued

The complete line of **air** and **hydraulic components** manufactured by Hydraulic Power Division, The Hydraulic Press Mfg. Co. is covered in a 28 page catalog. Ask for your copy.
Circle 64 on Reader Service Card

If you specify or design joints requiring **gaskets**, a study entitled "How flange surfaces affect gasket performance" will help you. Request a copy of this booklet from Johns-Manville.
Circle 68 on Reader Service Card

Linear Inc., states their new design of a split **V-ring packing** gives leakproof operation. They'll gladly send you complete information.
Circle 75 on Reader Service Card

Special interlocking mechanism of Ortman Miller Machine Company's **air** and **hydraulic cylinders** is one of many features described in their catalog.
Circle 92 on Reader Service Card

Designed for high pressure use, providing leakproof, vibration-resistant seal are **flareless fittings**, illustrated in a catalog published by The Weatherhead Company. It's yours for the asking.
Circle 129 on Reader Service Card

A new differential **relief valve** of greater capacity is described in literature available from Gresen Manufacturing Co.
Circle 54 on Reader Service Card

You may write Chikson Company for their latest industrial catalog, G-4, on ball bearing **swivel joints**. Designed to give unlimited flexibility in piping hydraulic systems.
Circle 28 on Reader Service Card

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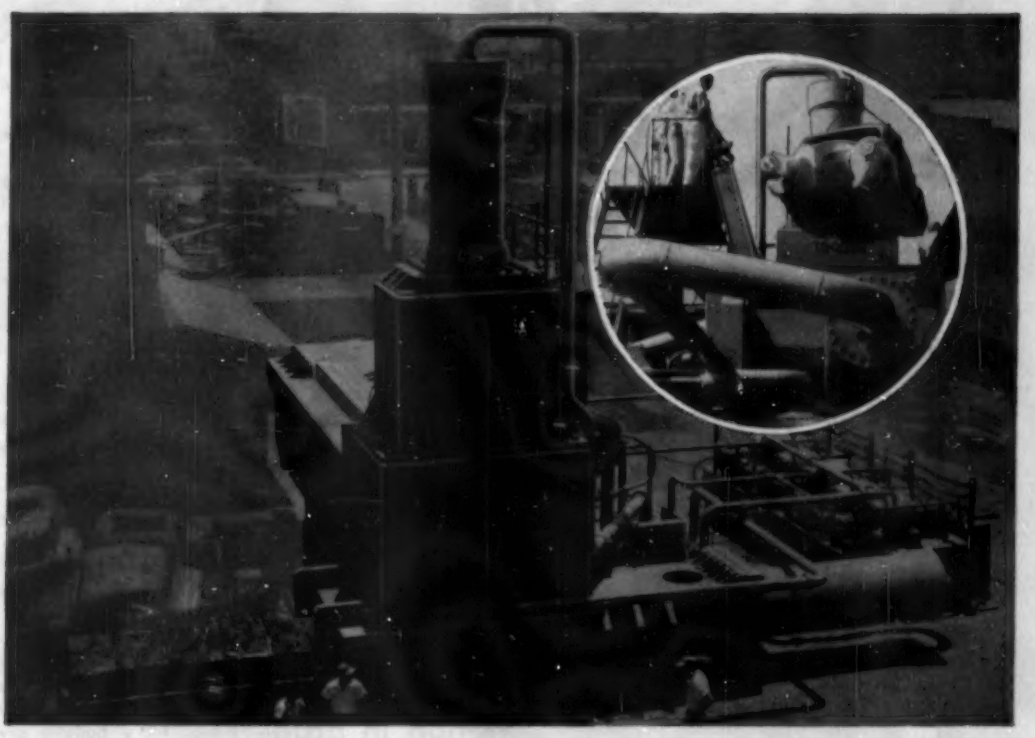
world's largest scrap-baling press gets HONAN-CRANE Oil Purification!



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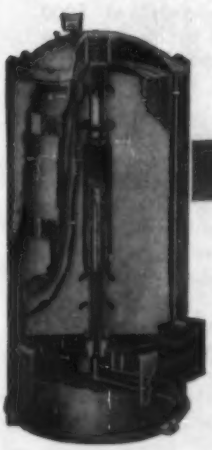

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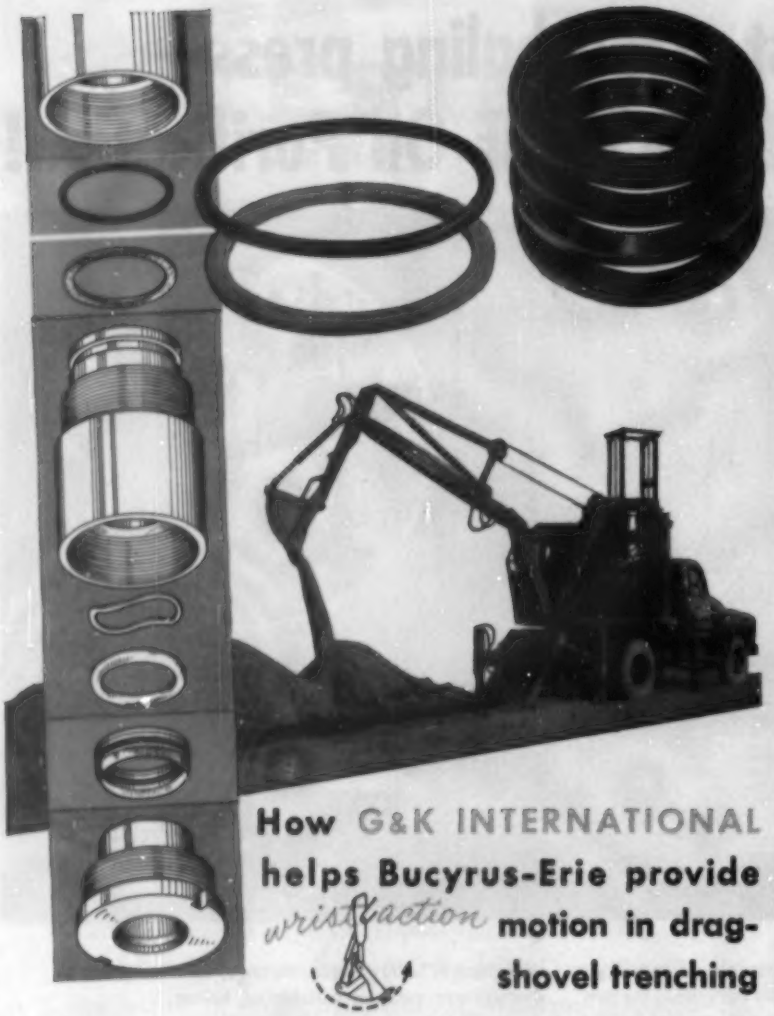

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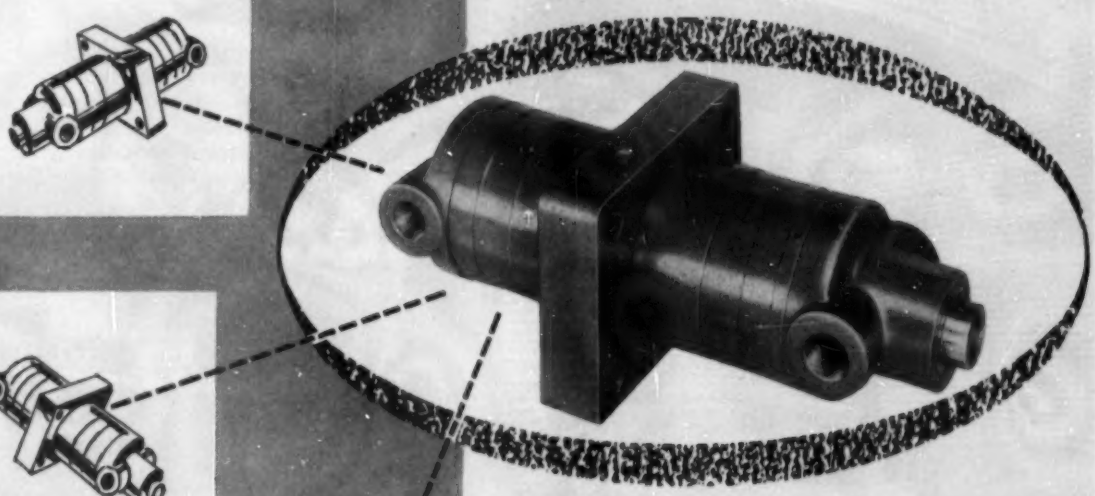

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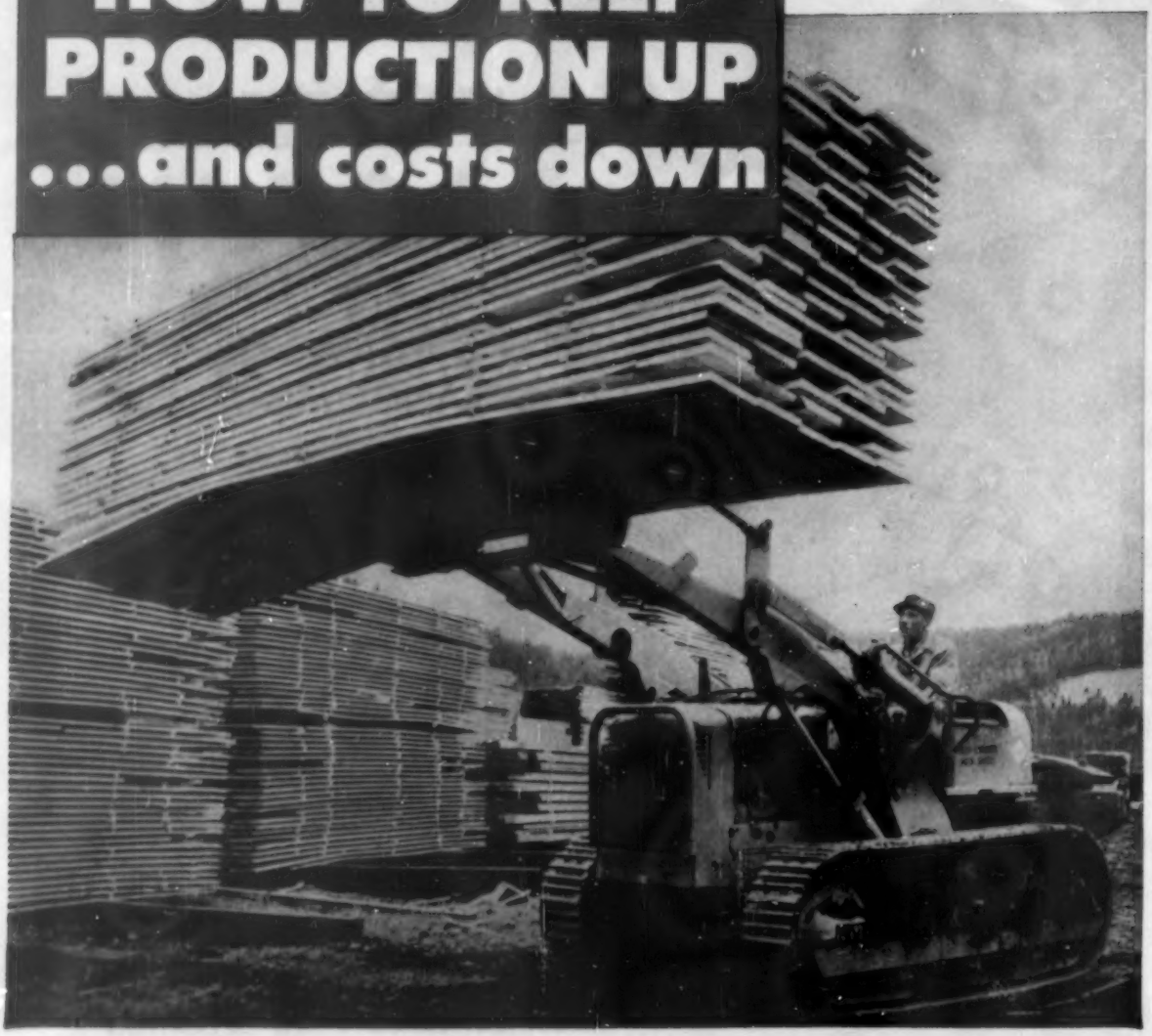

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Design of a RECIPROCATING OIL INTENSIFIER

● By Frederick J. Shaltz

Here's a way to step up low pressure pump output to meet high pressure requirements.

THERE are many applications of hydraulics where the required pressure at the working station is beyond the range of a low cost pump. Pressures over 5000 psi are readily developed by intensifiers or boosters. Where the volume demands of the applications can be met by the low and often pulsating delivery from an intensifier, an economical high pressure circuit can be obtained.

Intensification of hydraulic pressure is a well known hydraulic practice. If hydraulic pressure of a given magnitude is supplied to the larger one of two rams, then obviously the smaller one will produce a pressure equal to the supply pressure times the ratio of area of the two rams. This, of course, is disregarding efficiency which as a general rule is 90 to 95 percent.

We had need for an intensifier to be used in a cir-

FREDERICK J. SHALTZ, *Machine Designer, A.C. Spark Plug Division, General Motors Corporation, Flint, Mich.*

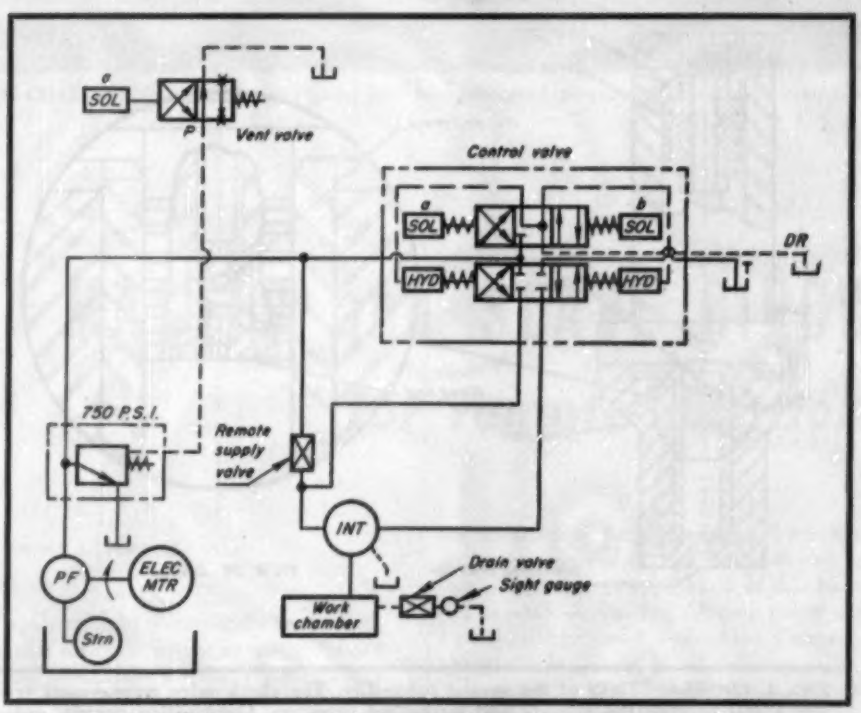


FIG. 1. HYDRAULIC CIRCUIT using a specially designed intensifier.

cuit which is schematically shown in Figure 1. The cross-sectional drawing, Figure 2, of the specially designed intensifier illustrates the construction and operation of this unit. This intensifier is a rugged unit which is capable of fast cycling and will intensify to a maximum of 8000 psi with a primary pressure of 1000 psi. The construction provides a 6:1 safety factor.

REMOVAL OF TRAPPED AIR

To rapidly fill the work chamber with oil while simultaneously bleeding off the air, the remote supply valve and drain valve, Figure 1 are held open while the pump supplies oil at 50 psi. At this time the relief valve is being vented, both the vent and control valve are deenergized. Opening of the drain valve permits trapped air to escape while the intensifier and work chambers are being filled. When no air bubbles are seen in the sight glass, the supply valve and drain valve are shut off and the intensifier is ready for a work cycle.

The vent valve is energized to permit pressure build-up to the relief valve setting. Solenoid A of the control valve is energized to direct oil at primary pressure to the inlet port of the intensifier. As the large intensifier piston moves downward, the ball check in the bottom of the small piston seats itself to seal off the intensified chamber from the primary oil supply. Intensified pressure is now developed in the work chamber. When the control valve is reversed the intensifier piston moves upward. Approximately 1/16 inch from a closed position, the ball check rod contacts the face of cylinder cap and if any oil is lost during the previous cycle, it is replaced automatically. The intensifier chamber would act as a vacuum and the oil on top of the large piston, which is not entirely exhausted, would enter the intensifier chamber. It is assumed of course, that the volume leakage has not been in excess of the 1/16 inch movement times the area of the primary cylinder diameter. Any excessive leakage condition must be corrected for proper operation.

To date, there are over one million cycles on each of several of these intensifiers. This is a good indication that all special requirements for a specially designed intensifier have been achieved.

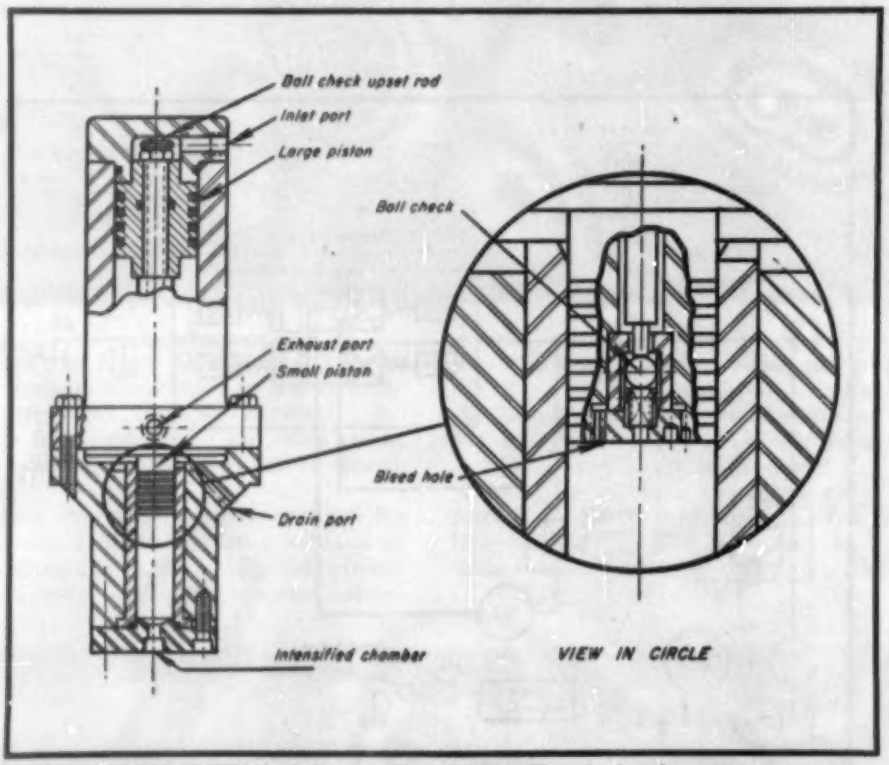
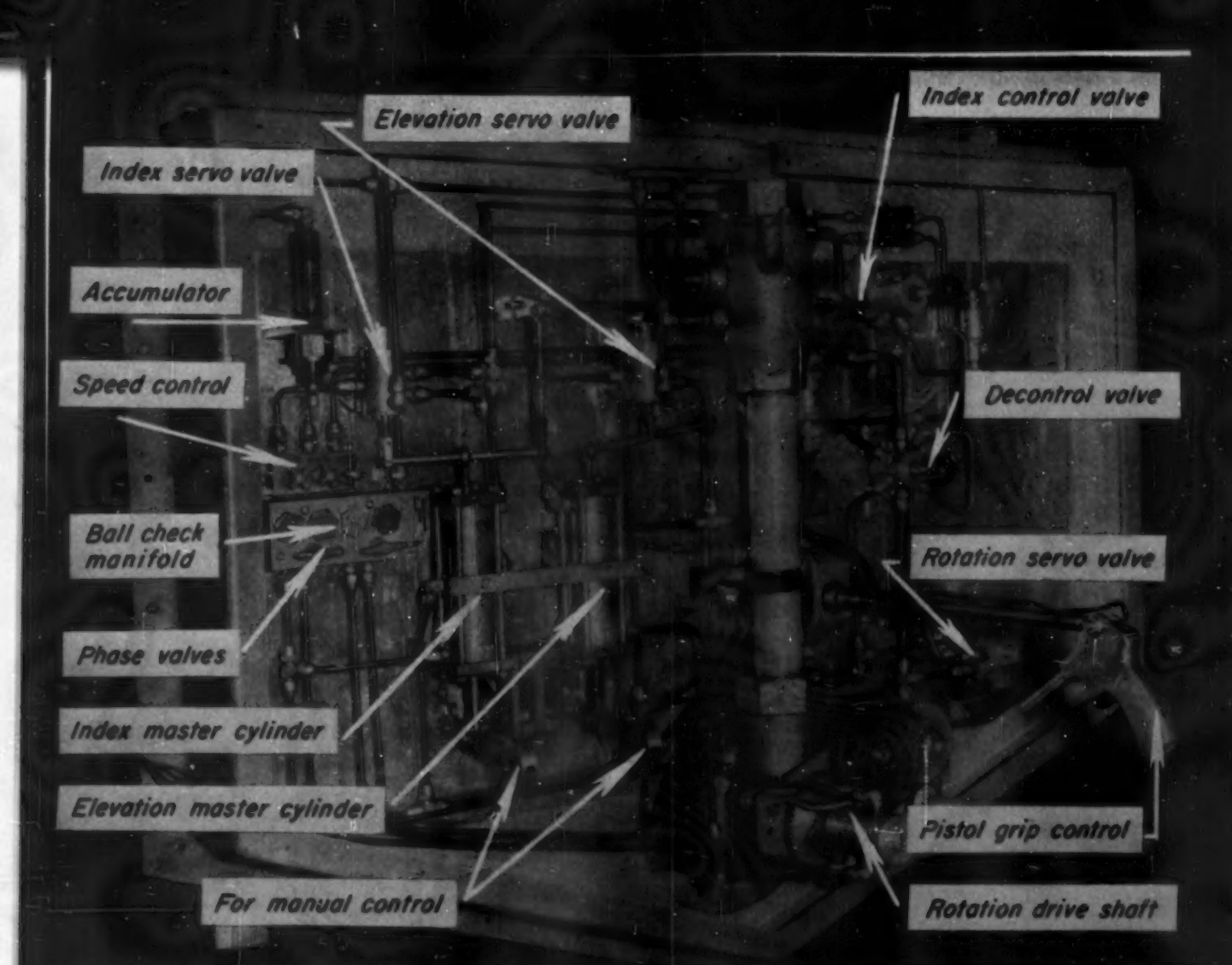


FIG. 2. CROSS-SECTION of the special intensifier. The check valve arrangement creates a seal between the primary and intensified pressures. Construction permits automatic replenishing of any intensified oil lost during the work cycle.



BOTTOM COVER of the turret control panel has been removed to show the hydraulic components.

MASTER and SLAVE CIRCUITS

for remote positioning

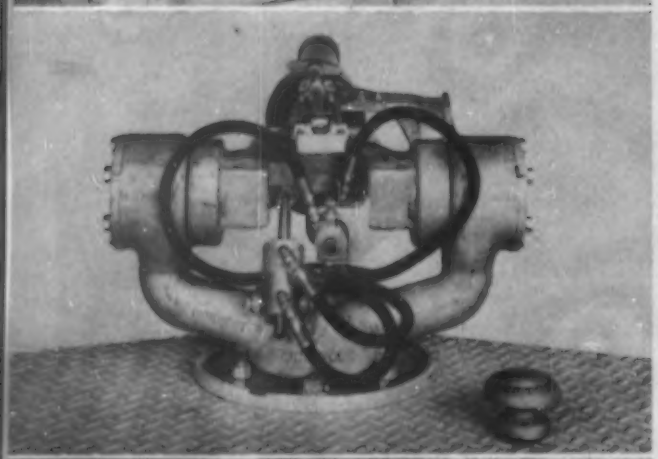
• By Edmund L. Nichols

PROPER application of master and slave hydraulic systems can offer a simple answer to many difficult remote positioning jobs. There are many places where the installation of such circuits will result in improved accuracy, faster operation and reduced operator fatigue. An excellent application of this basic servo circuit is used on the fire fighting turret designed and built by Rockwood Sprinkler Company for crash rescue trucks.

Designing a servo circuit into the controls of the fire fighting turret has resulted in greater efficiency primarily because the job of the operator has been

EDMUND L. NICHOLS, *Project Engineer, Rockwood Sprinkler Company, Worcester, Mass.*

MASTER AND SLAVE CIRCUITS



TURRET-MOUNTED fire fighting equipment on top of the crash truck is positioned by the operator in the cab. The elevation and indexing slave cylinders are connected by hose to the master cylinders located on the underside of the panel. Indexing changes the type of nozzle or spray head in front of the fluid stream.

greatly simplified. On this job, the designers had to develop a system which would permit the operator to aim the turret-mounted fire nozzle. This would be simple if the operator could see the nozzle on top of the truck, but he is unable to do so from his location in the cab. Fighting a fire requires considerable alertness which should not be disturbed by complicated positioning requirements.

What does the design of the master and slave circuit mean to the operator? The circuit permits him to control the entire turret movement from a pistol grip control. He knows that he can accurately aim the stream of fluid from the nozzle by moving the pistol handle. The turret will move in exact relationship to the handle. He knows at all times where the turret is aimed because it has the same position as his handle. Speed and position of the turret are identical to the speed and position of the control. The system permits a total rotation of 210 degrees, 105 degrees either side of center, and the nozzle can be elevated through an arc of 100 degrees (10 degrees below vertical to 20 degrees below horizontal).

SERVO SIMPLIFIES OPERATOR TRAINING

One of the earlier stages of design used a hydraulic system which did not have the servomechanism control. Motion was controlled by moving a handle on a three position, 4-way valve. Its movement had no relationship to turret position. When the turret was stopped by putting the hydraulic valve in neutral, the operator had to check an indicating arrow to tell in what position the turret had been left. Training an operator with this device took considerable time. This training time has been reduced to a minimum by the installation of servo operated turrets.

There are actually three servo circuits on the turret. One powers the rotation; the second provides elevation control, and a third acts to index three different stream control heads in front of the nozzle. The indexing hydraulic circuit, which provides the three types of stream discharge: straight, intermediate and fog foam is operated by a separate index control handle.

The pistol grip actuates two independent hydraulic systems which control the elevation and rotation of the turret. The control column holds the pistol grip at a convenient height and transmits the pistol motions to the valves in the hydraulic systems. A trigger switch on the pistol operates a valve in the turret feed line, which controls the fire fighting stream. The switch actuates a solenoid valve which controls the flow of oil from the hydraulic system operating the shut-off valve. Pressing the button stops the water flow; Releasing the button allows the water to flow again.

For some reason, (loss of oil, pressure, etc.,) it may be necessary to operate the turret manually, it is possible to do this from inside or atop the cab. A decontrol valve, which is actually a bypass in the hydraulic lines, connects directly two lines of the circuit which are normally separate. Instead of having one decontrol valve in each circuit, the elevation, rotation and indexing circuits are all connected to one decontrol valve so that these circuits are decontrolled

(changed to manual operation) simultaneously.

The elevation and indexing circuits are basically identical. The circuits require 500 psi and about 3 gpm. Each has a sliding spool type 4-way valve and double acting primary cylinder. Actual movement of the turret is accomplished by a slave circuit system of parallel acting cylinders mechanically controlled by the primary cylinder. The rotation circuit has a special rotary spool type 4-way valve and a fluid motor geared to the turret. The 4-way valve is special in that an integral gear system is used for servo purposes.

Figures 1 through 5 illustrate the step-by-step development of the master and slave system used on the elevation and indexing circuits. If two hydraulic cylinders are connected, as in Figure 1, and completely filled with hydraulic fluid at the same pressure, moving the piston of one causes the second piston to move in the same direction. If the diameters of the cylinders are equal, the two pistons move the same distance. The cylinder with the handle is the master cylinder, since it controls the position of the second cylinder, which is the slave cylinder. If the slave cylinder is connected properly to part of the turret assembly, the motion of that part can be controlled by means of the handles on the master cylinder. The indexing and elevation manual controls are handled in this way.

There must necessarily be a way of getting oil into the lines of this circuit and it is accomplished as in

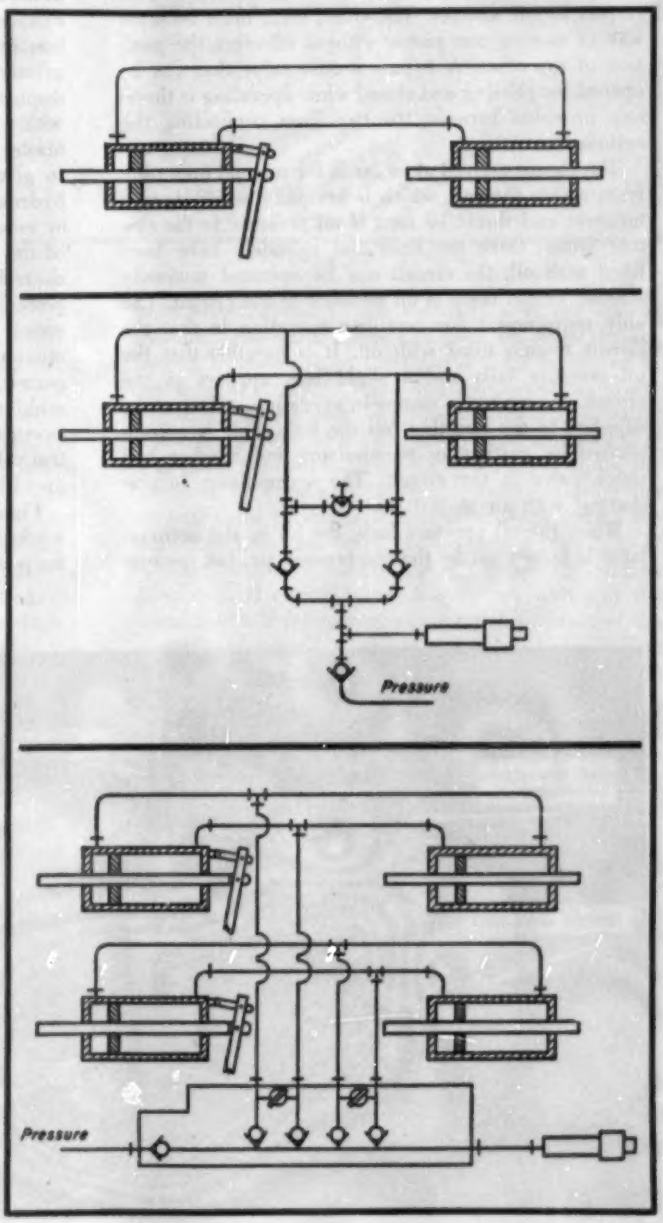


FIG. 1. BASIC MASTER and slave system is two parallel connected cylinders. When the system is full of oil both double ended, equal bore cylinders will move the same distance when the handle on the master cylinder is moved. This setup permits manual operation.

FIG. 2. OIL IS SUPPLIED to the system through the check valve arrangement which prevents the oil from getting out of the cylinders. A needle valve is in the circuit to permit "phasing" of the cylinders. The small accumulator helps to keep the system full of oil in the event of an oil leak or failure of the oil supply.

FIG. 3. ON THE CRASH TRUCK turret, both the elevation and indexing circuits are similar. The check and bypass valves are built into one compact manifold.

MASTER AND SLAVE CIRCUITS

Figure 2. The oil goes in through ball type check valves so that once the oil gets in, it cannot back out. This allows the circuit to be run manually whether there is oil pressure going to the circuits or not (once the circuit is filled). The ball check valves open at approximately 275 psi and close when the lines are filled.

The two pistons must necessarily reach the proper end of their strokes simultaneously (be in phase), otherwise, the total movement of both pistons will be reduced. When the oil rushes in to fill the cylinders and hydraulic lines, the pistons can be anywhere with respect to one another. Therefore, there must be some way of moving one piston without affecting the position of the other. A bypass needle valve that can be opened for phasing and closed while operating is therefore provided between the two lines connecting the cylinders.

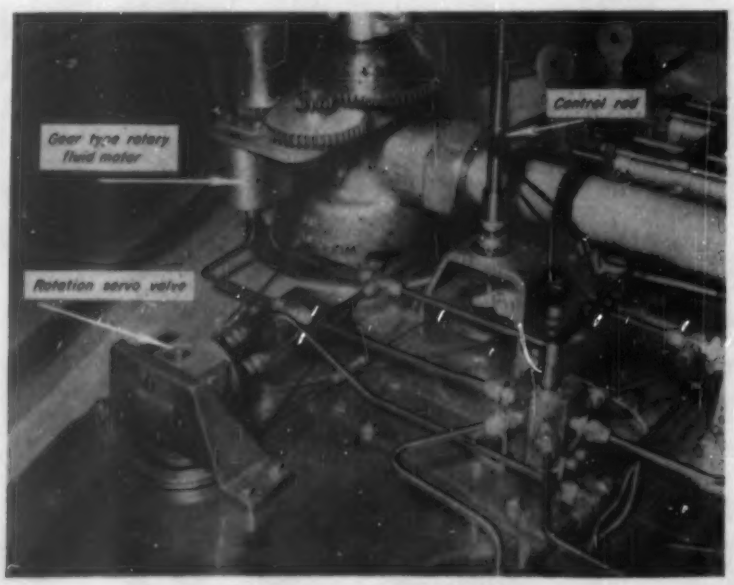
The circuit arrived at so far is for manual operation from within the cab, which is normally an emergency measure and would be used if oil pressure to the system failed. Once the lines and cylinders have been filled with oil, the circuit can be operated manually whether or not there is oil pressure in the circuit. The only requirement for complete operation is that the circuit remain filled with oil. It is possible that the oil pressure fails and a slight leak appears in the circuit. To maintain complete operation, oil must be supplied to the line that has the leak. This is accomplished by putting an accumulator and another ball check valve in the circuit. The accumulator is precharged with air at 200 psi.

When the oil pressure fails, the oil in the accumulator is forced out by the compressed air, but because of the ball check valves, it cannot flow anywhere except in a line that is losing oil. Complete manual operation can therefore be maintained until the accumulator is empty of oil. The accumulator is a safety device to offset two conditions occurring simultaneously, (1) the oil fails, (2) a slight leak develops in the circuit. For compactness, the ball check valves and needle valves of both the elevation and indexing slave circuits have been incorporated in one piece of equipment, the ball check manifold, as shown in Figure 3.

ARRANGED FOR POWER CONTROL

Starting with Figure 1 again, to move the piston of the slave cylinder, the piston of the master cylinder is displaced by moving the shaft with an external force at the handle. If the shaft of the third cylinder (primary cylinder) is connected by a link to the shaft of the master cylinder, as in Figure 4, movement of this primary cylinder will cause the slave cylinder to be displaced. If, now instead of connecting the two shafts with a link, a common shaft is used, the primary and master cylinders can be brought together as one unit to give a duplex cylinder. This gives two cylinders, hydraulically independent, but connected mechanically by means of a common shaft. Controlling the position of the primary cylinder by use of a valve will allow control of the slave cylinder position. A needle valve, placed in the pressure line, allows control of maximum speed. The turret can operate at any rate up to the maximum speed permitted by the speed control. To permit operation by use of the manual handle now requires a bypass (decontrol) valve in the lines between the valve and the primary cylinder. The decontrol valve allows the oil to bypass the valve for manual operation and seals the bypass for hydraulic operation.

Figures 6 and 7 show how this type of servo system works. The elevation of the turret head depends on the position of the duplex cylinder as motion is started



ROTATION OF THE TURRET is powered by a servo controlled gear type fluid motor. This closeup shows the pulley arrangement which moves the servo valve in response to the operator's movement of the pistol grip.

FIG. 4. TO POWER THE MASTER and slave system hydraulically with little effort from the operator, a primary cylinder is coupled to the master cylinder. Both the master and primary cylinders may be combined to form a compact duplex cylinder.

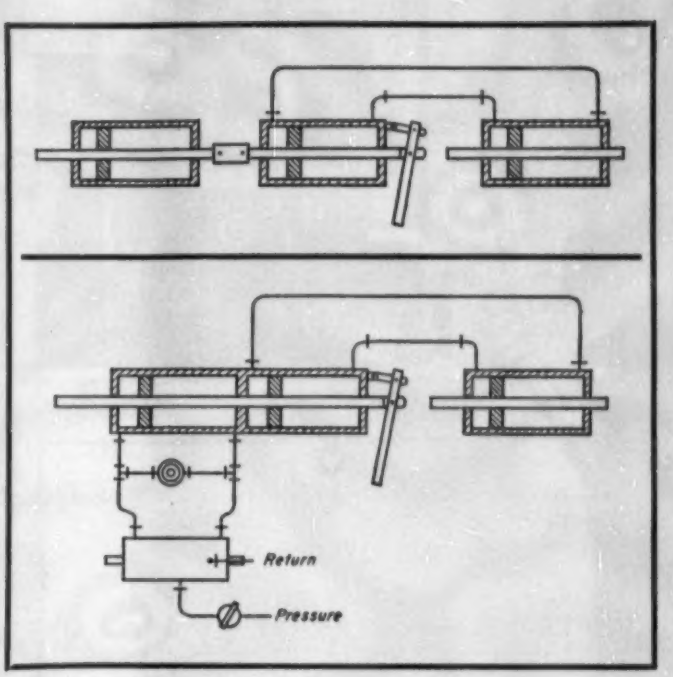
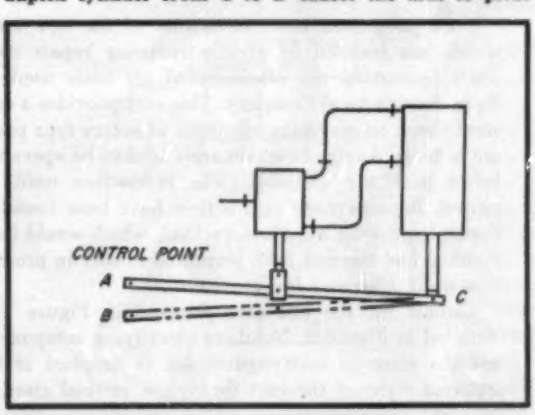


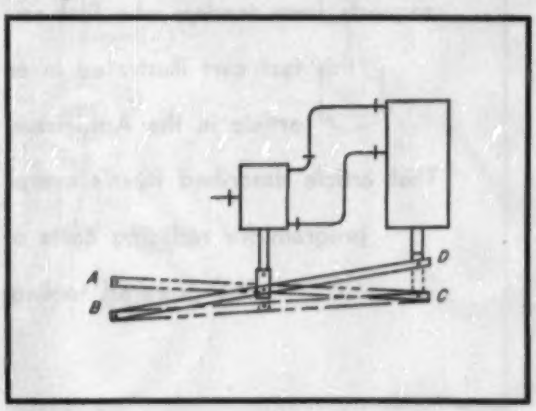
FIG. 5. A SERVO VALVE CONTROLS the motion of the primary cylinder which in turn powers the master and slave circuit. A needle valve placed in the pressure line provides speed control. A bypass valve in the lines between the servo valve and the primary cylinder is used to decontrol the hydraulic power circuit and permit manual operation.

at the primary section of the duplex cylinder. The follow-up system is such that the valve is opened by a movement of the control lever and is closed by a corresponding movement (follow-up) of the duplex cylinder. The system is set up as in Figure 6 and it must be remembered that the valve is closed in only one position. The valve cylinder port which opens is the one which is in the direction of the valve shaft movement. It is necessary for the valve to be connected to the duplex cylinder so that a motion of the valve produces the opposite motion of the duplex cylinder to close the valve. Starting off in this closed position, the control point is moved from A to B. Since the duplex cylinder does not move unless the valve is open, the arm pivots about C, the connection at the duplex cylinder. The valve opens and must be closed by the duplex cylinder. Once the control point is moved to position B, it is held there and the movement of the duplex cylinder pivots the arm about the control point. Thus, the motion of the duplex cylinder from C to D will cause the arm to pivot about B until it closes the valve as in Figure 7. Since the distances from the control point to the valve and from the valve to the duplex cylinder are equal, the movement from C to D is equal to the movement from A to B. The motion from A to B caused by an angular movement of the pistol grip will produce an equal angular motion of the turret head caused by the motion from C to D. The

Concluded on page 102

FIGS. 6 and 7. PRINCIPLE OF THE FOLLOWUP SYSTEM: The valve is opened by the operator moving the control handle from A to B. The rod pivots around C. With the rod held at B, movement of the oil powered duplex cylinder from C to D causes the arm to pivot around B, causing the valve spool to shift to the closed position. The movement of the cylinder is proportional to the movement of the valve spool. Actually, the valve and cylinder move almost simultaneously without visible lag.





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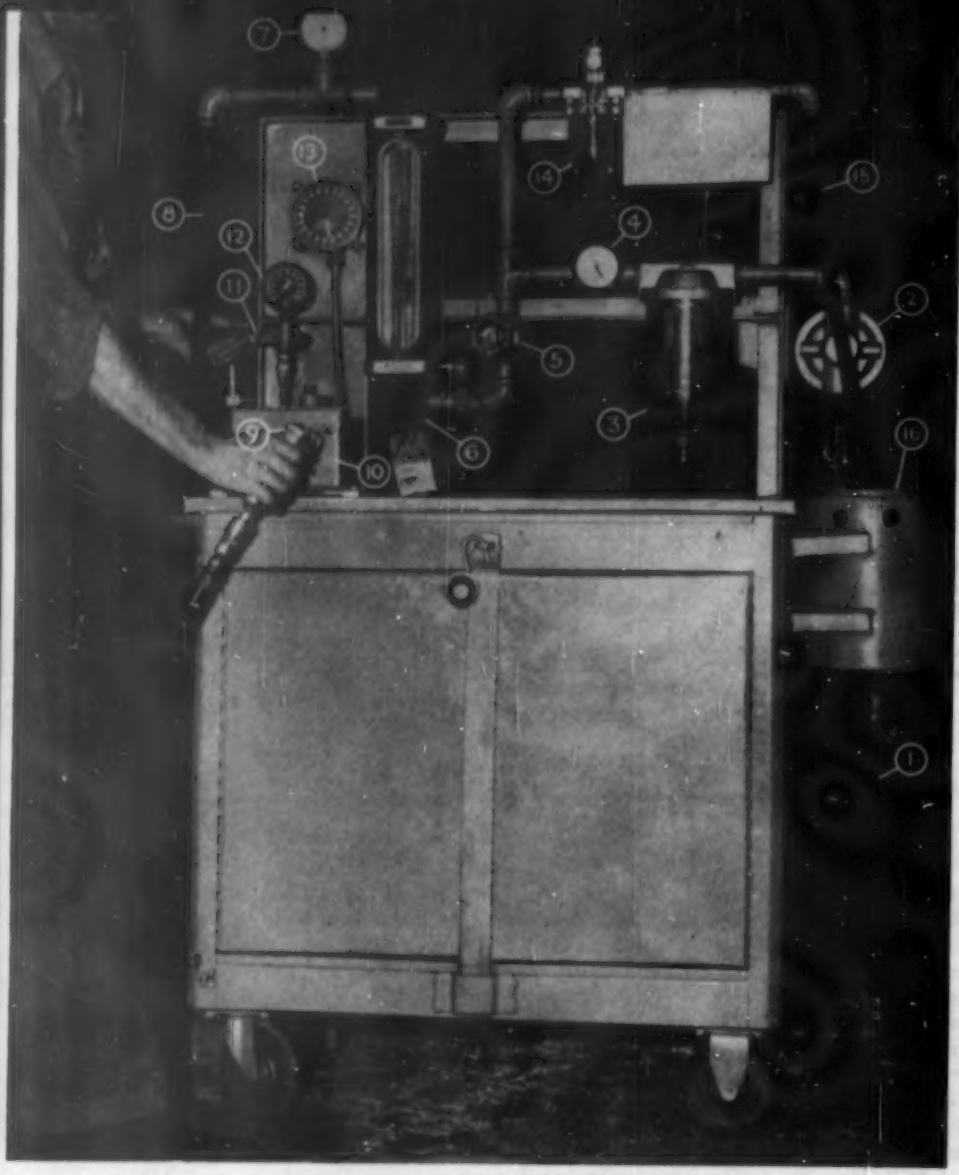


FIG. 1. EQUIPPED with test instruments and oiling devices, this cart moves through the shop to check air tools in use.

Here's a construction story for which we've had requests from readers who first saw this test cart illustrated in an article in the April issue. That article described Ryan's overall program for reducing costs of air powered tooling.

A pneumatic test cart is one of the new ideas which has resulted in greatly reducing repair costs while increasing the efficiency of air tools used by Ryan Aeronautical Company. This cart provides a constant check on operating efficiency of rotary type pneumatic tools. Any tools which are found to be operating below peak are removed from production until repaired. Repairs made at this time have been found to cost a fraction of a major overhaul, which would have resulted had the tool been permitted to stay in production until it became inoperative.

Circuit for the test cart pictured in Figure 1 is detailed in Figure 2. Numbers identifying components are the same in each figure. Air is supplied at the extreme right of the cart through a vertical riser, 1.

TEST STAND CONSTRUCTION

for Checking Pneumatic Tools

Pressure regulator 2 is set at 70 psi. Air passes through the regulator to the bowl type filter 3 which removes any foreign matter which might injure the instruments or tool.

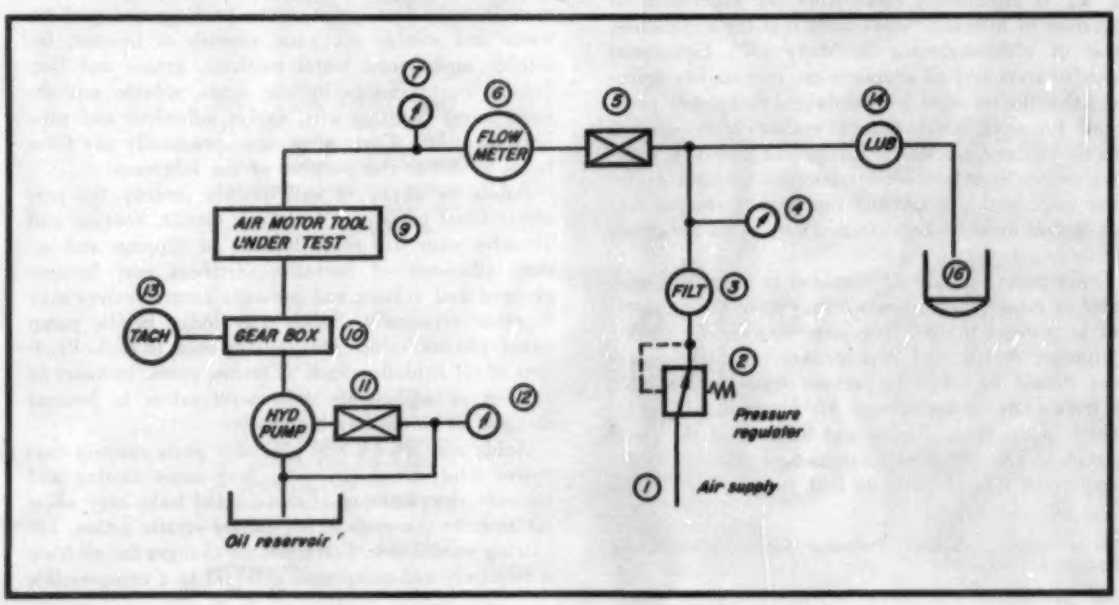
Immediately after passing through the bowl filter, the pipeline incorporates a pressure gauge, 4. Then the pipe comes to a T section with the vertical riser going up to the top of the test cart and making a right turn when a bowl type oiler, 14, is inserted in the line. This line then continues out to the right and a hose, 15, is attached to the line for oiling the pneumatic tools. The other component of the line, coming from the pressure gauge, goes down in a vertical direction and then makes a right angle turn to a large flow meter, 6, coming in at the bottom of the flow meter. From the top of the flow meter, and slightly to the left of it, another pressure gauge, 7, is inserted in the line. This line is then passed into a hose which goes to the tool being tested.

In addition to these instruments there is a tachometer, 13, which is shown immediately to the left of the flow meter. Also, there is a hydraulic pressure gauge, 12.

To test a tool, it is chucked into the shaft in gear box 10, which drives the tachometer and a hydraulic pump. The hydraulic pump acts as the load on the air tool. This load is regulated by adjusting needle valve, 11. Output speed of the tool is read on the tachometer. When the tool is chucked to the shaft, and the valve, 11, on the hydraulic system is open, the hydraulic fluid is pumped out of the reservoir, through the valve and back into the reservoir. If valve, 11, were closed completely, it would tend to stall the air tool motor, because pump pressure would go to the maximum setting of a safety relief valve. Ryan has effected a system in which the valve is closed until a reading of 1200 rpm is attained on the tachometer; then the

Concluded on page 102

FIG. 2. LAYOUT OF the components used on the test cart.



To increase the life of your hydraulic oil
and to eliminate system failures
caused by contamination, you must know . . .

How to CARE *for Hydraulic* OILS

By John R. McCoy

- Reservoir Design
- Oil Contaminants
- Types of Filters
- Filter Circuits

IT is abundantly clear from the experience of operators of hydraulic equipment that the commonest cause of malfunctioning is "dirty oil". Equipment manufacturers and oil suppliers are in complete agreement that the oil must be maintained completely clean at all times if the hydraulic system is to operate trouble-free and efficiently. Equipment bulletins, operating instructions and service manuals of both equipment manufacturers and oil suppliers stress the fact that the oil must be kept clean. *There is no substitute for clean oil.*

Every means should be provided to keep dirt, grit, water or other contaminants from entering the system and to prevent the oil from deteriorating by proper equipment design and maintenance. Special precautions should be taken to prevent water and soluble oil from entering the system. Air filters should be installed on the vents. Piping and baffling of the reservoir should be provided to separate intake oil to the pump from returning oil so that the air may be allowed to separate. Coolers should be provided, if necessary, to keep the oil at the proper temperature. Proper protection should be provided to keep piston rods clean. Oil-filler holes should be provided with adequate strainers.

Driers should be installed on breather tubes in humid atmospheres and where there is excess condensation in the system. Condensation occurs principally when ambient temperatures fall below the dew point of air in the reservoir. If water is a problem, it may be desirable to equip the reservoir with a water leg having a suitable drain. Frequent inspections are necessary in outdoor locations.

In spite of all design precautions to keep oil clean and free from deterioration, it will still get dirty and it will deteriorate unless proper filters are installed.

Mineral base hydraulic fluids or oils are subject to contamination by both soluble and insoluble contaminants. Insoluble contaminants include dust from the air, core sand and abrasives left on the parts after manufacture, dust, paint, worn packing and gaskets, water and soluble oil, gum, varnish or lacquer, insoluble asphaltenes, metal particles, grease and lint. Soluble contaminants include acids, soluble asphaltenes, mineral-cutting oils, gasket adhesives and pipe dope or sealers. Contamination in practically any form tends to defeat the purpose of the lubricant.

Solids or abrasives will quickly destroy the precision fitted parts in a hydraulic circuit. Scoring and abrasive wear will cause leakage or slippage and reduce efficiency of operation. Orifices may become plugged and volume and pressure control valves may function erratically. Solids may lodge in the pump vanes, pistons, valves, etc., causing them to stick. Products of oil oxidation such as resins, gums, lacquers or varnish or asphaltenes will cause valves to become sluggish or completely inoperative.

Acids may attack fine precision parts causing corrosive wear. Excessive water may cause rusting and promote deterioration of the oil. Oil leaks may allow air to enter the system. Air causes erratic action, impairing smoothness. Entrained air changes the oil from a relatively non-compressible liquid to a compressible

JOHN R. MCCOY, *Manager, Technical Service, Honan-Crane Corporation*

FIG. 1. A LINE TYPE, extended area wire mesh filter is used on pump intake lines.

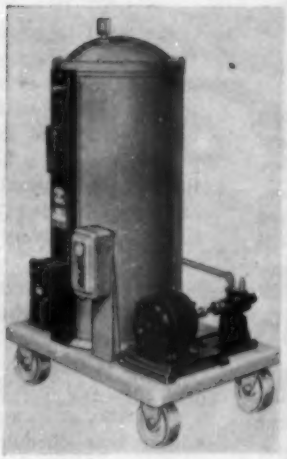


FIG. 2. THE PORTABLE, self-contained continuous filter unit is often advantageous for filtering oil while the hydraulic system is in operation.

medium. Air also introduces oxygen which increases the oxidation of the oil.

Heat probably contributes more to oil breakdown than any other single factor. Average oil temperatures may run as high as 200 F in some systems; however, most systems will normally operate at temperatures lower than 140 F. As the oil is pumped through the system, it is caused to heat up by friction of the operating pump, pump leakage or slippage, oil flow through the lines, valves and small orifices and high pressure. Abnormally high operating temperatures are dangerous in two ways; (1) it thins the oil down so that rapid wear may occur; and (2) it promotes oxidation of the oil and formation of sludge. Water and products of oxidation, dirt and certain metals act as catalysts to accelerate oil oxidation.

The average temperature of the oil in the reservoir is not necessarily representative of the oil temperature in all parts of the system. Localized "hot spots" occur where oil is forced through small orifices at high pressures and when pressure is suddenly increased. Oil slippage in pumps and motors also causes heat.

The very nature of the hydraulic action causes violent agitation and mixing of the oil with air. As oil oxidizes, the asphaltenic materials are first soluble in oil, but as oxidation continues, the oil will become saturated and asphaltenes will begin to precipitate out as solids. They will precipitate on the cold surfaces of the cooler tubes first; the accumulation may reach a point as to insulate the tubes and render them valueless for heat transfer. In extreme cases such precipitates may plug cooler tubes entirely.

Hydraulic oils do not wear out; they become unfit for further service because of the presence of a very small percentage (a fraction of one percent) of contaminants. Additives will become spent and only costly and time-consuming tests can determine when they are no longer effective.

FIG. 3. A CARTRIDGE type depth filter removes contaminants as the oil passes through the central cellulose fiber, the cotton cartridge cover plus the processed fuller's earth.

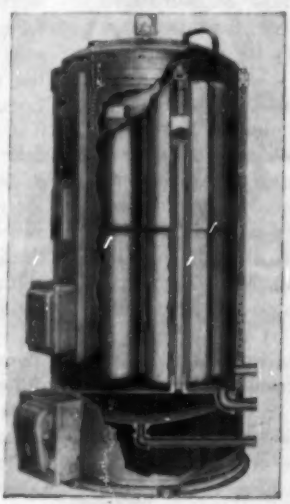
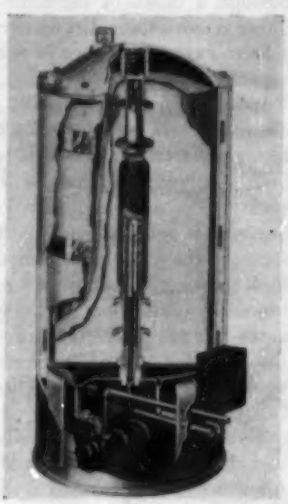


FIG. 4. A BULK TYPE continuous oil filter or purifier. Pump driven dirty oil enters the base inlet, is divided, passes through the perforated metal basket, filter cloth bag and the diameter of the fuller's earth.



Sediment tests are not always reliable to show when an oil is too dirty for further use. A very small amount of abrasive will do considerable damage to a hydraulic system and not show up in a sediment test. The I.F.T. (Inter Facial Tension) test might be used as a criterion to indicate when straight mineral oil will start to sludge; however it cannot be used on rust-inhibited oils because the rust inhibitors themselves cause a low I.F.T. A deteriorated condition of the oil may be indicated by an elevated neutralization number.

Changing oil is not the answer to preventive maintenance of hydraulic fluids. Changing oil only drains contaminants that have accumulated in the system and have remained suspended in the oil; it does not drain the damage that has already been done. The only way a system can be maintained in an absolutely clean condition, as equipment manufacturers specify, is by continuous filtration.

There are many types of filters in use on hydraulic systems. Most equipment manufacturers install a rough strainer-type filter on the intake line of the pump. This type is usually made of accordion-pleated 100 or 200-mesh screen wire. Such filters give a measure of protection, but are not intended to maintain the oil abrasive-free. They only catch the "nuts and bolts". Openings of 100-mesh wire are approximately 0.006 inches or 150 microns in size, i.e., it will pass particles as large as 150 microns. The 200-mesh wire has openings of 0.0029 inches or 73 microns in size and will pass particles of that diameter. It is apparent that a 100 or a 200-mesh wire screen will not adequately protect precision-built valves which may have clearances of 5 microns in size. For adequate protection, the oil should be maintained free of all solids larger than the thickness of the oil film or larger than the clearances of the closest-fitted parts in the hydraulic system.

Filters may be divided into many classes, e.g., depth-type, extended-area or surface-type, adsorbent, absorbent, cartridge-type, bulk-type, edge-type, etc. Depth-type filters remove contaminants by passing through a depth of the filter medium. Extended-area filters remove their dirt on the surface; for this reason a large exposed surface is necessary for dirt catching capacity.

Inert-type filters are usually recommended where it is desired to remove only solid contaminants. Adsorbent filters are recommended where it is desired to remove both soluble and insoluble contaminants. Fuller's earth is the adsorbent most commonly used for this purpose. It is recognized that fuller's earth will remove some of the inhibitors in hydraulic oils; the rust inhibitor being the one most affected. Many operators, however, prefer the advantages afforded by fuller's earth filtration over that afforded by the additives in the oil. One of the large automotive manufacturers equipped practically all of its hydraulic systems with fuller's earth filters.

Bulk-type filters are usually equipped with baskets and center tubes. Refills made up by the operator from filter medium purchased from the fiber manufacturer make this type relatively inexpensive to service. Bulk-type filters may use either adsorbent or absorbent-filter media. The cost of filter cartridges are much less than the cost of ready-made filter cartridges. Although more labor is involved in changing refills, it is a simple process to pack a bulk-type filter; special equipment for the job is usually not required. Bulk-type filters are normally not used where high flow rates are desired or where very heavy (high viscosity) oils are encountered.

Refill life is determined by the amount and nature of the sediment which is removed by the filter. The nature and amount of the contaminants are usually variable factors. The time for changing a refill may be determined in a number of ways depending on the type of filter or its application. It may be changed on a routine time schedule, by pre-determined accumulated, operating time, when the pressure drop increases to an objectionable level or by the condition of the oil.

FILTER INSTALLATIONS

Probably the most desirable and efficient method of operation is to use an auxiliary pump and motor to pick up the oil from the reservoir, pass it through the filter, and return the oil to the reservoir. In this case, the filter operates completely independent of the rest of the system. No orifices, pressure control valves, or flow control valves are necessary for installation. Oil can be filtered continuously, if desired, whether the hydraulic system is operating or not. The filter may be shut down for changing refills without interfering in any way with the normal operation of the hydraulic system. Almost any type of filter can be operated with an auxiliary pump and motor. Flow through the filter is maintained constant at all times. Ideal operating conditions can be maintained because of constant, even flow without the surges caused by increasing or decreasing pressure. Surges in flow caused by sudden increases or decreases in machine-operating pressures cause most filters to unload a small amount of this sediment back into the oil.

Filters may be installed to operate as a bypass system. They may operate from either the pressure side of the pump or the return side of the system. In the former case, one or more of several devices may be used to protect the filter against the full pressure of the system. Such devices include flow control, orifices, pressure control valves and flow control valves. The orifice is usually placed in the intake line to the fitler and a pressure relief valve placed between the orifice and the filter or in the filter. Many bypass type filters will not withstand high pressures and pressure relief valves are necessary to relieve the pressure if the filter cartridge becomes loaded. Pressure relief valve setting is controlled by the type of filter but the maximum setting is seldom higher than 60 psi.

Bypass type filters will normally take from 5 to 20 percent of the oil flow from the pump through the filter and return it to the reservoir. The flow or pressure of this volume can be regulated by flow control or pressure reducing valves. This range of oil flow is generally sufficient to maintain the oil in the entire system in good condition.

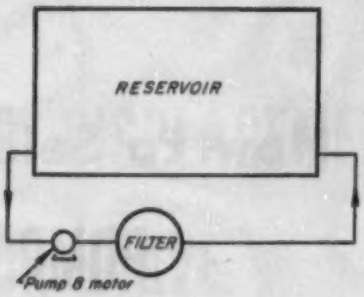


FIG. 5. A COMMON filtering setup is to use an auxiliary pump and motor to pick up the oil, pass it through the filter and return it to the reservoir.

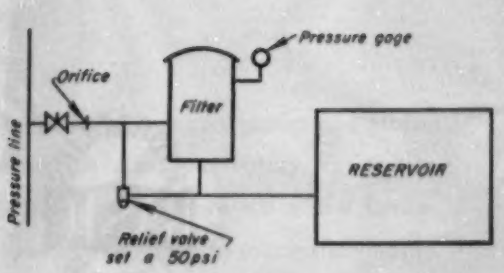


FIG. 6. A BYPASS SYSTEM may be arranged to operate, as shown, from the pressure side of the pump or from the return side of the system.

Some systems use a full flow filter on the pressure side of the pump. Shells of such filters must be designed to withstand high operating pressures and should be equipped with pressure relief valves that will open when the filter cartridge becomes loaded.

Full flow filters are usually of the entended area or metal-edge strainer types. Depth type filters are usually not suitable for full flow filtration because of the high pressure drop required to get the necessary flow. The extended area type filters utilize a throw-away type cartridge, while metal edge type filters utilize a cleanable element. Some metal-edge type filters contain devices for removing dirt from the filtering surface without removing the shell.

Continuous filtration is always the best method of operation. However, many operators prefer not to equip all of their machines with individual filters, selecting instead portable filtration equipment to service groups of machines. Such a portable filter is normally self contained with pump and motor, flexible hoses and necessary valving and normally mounted on a dolly so that it can be moved easily from one machine to another. The flexible suction and outlet hoses are in-

Continued on page 104

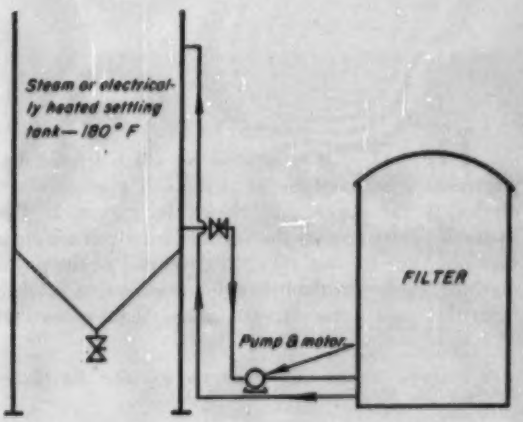
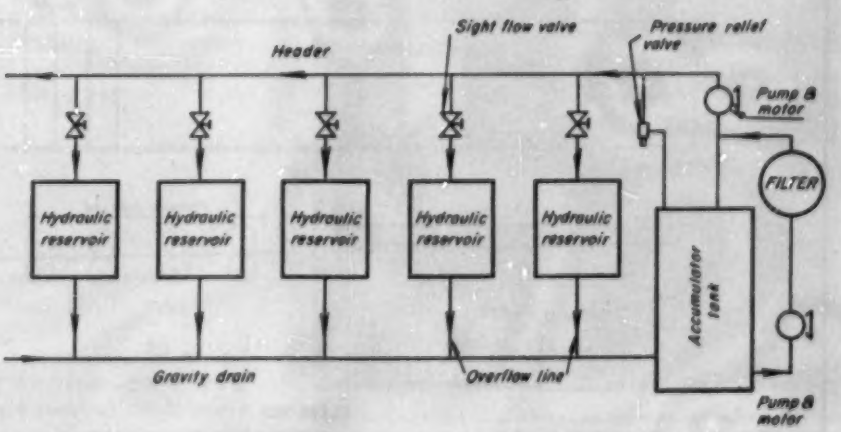


FIG. 7. BATCH treating of oil away from hydraulic machines, sometimes necessary to remove soluble oil and water from the hydraulic oil, is frequently accomplished in heated settling tanks. The elevated temperature tends to break down the water-in-oil emulsion, reduce the viscosity of the oil and facilitate the settling out of the water.

FIG. 8. ON CENTRAL hydraulic systems, this arrangement may be used for filtration. Overflow lines from individual machine reservoirs connect into an overflow line to an accumulator tank.



HYDRAULICS BASIC ARTICLE

How to Select a PUMP and

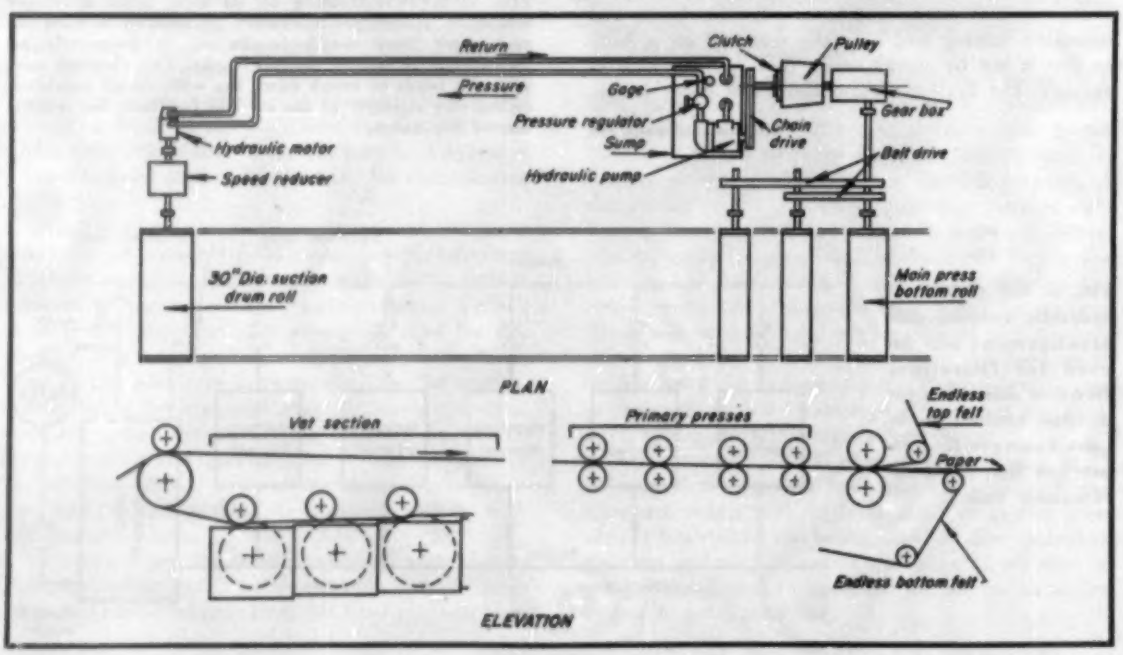
• By Gene Roberts

TYPICAL of the machines on which a fixed displacement pump and motor drive will give excellent service is the paper mill shown in Figure 1. The hydraulic drive powers the suction drum roll which is installed after the last vat on the wet end of the paper machine. Power for the hydraulic transmission is taken from the main press drive. Limited requirements of this drive permit the use of fixed displacement units.

It is common practice on these machines to have auxiliary drives on the primary presses. These drives are commonly called helper drives and their purpose is to relieve the main press drive of a portion of the wet end load. Figure 1 shows two primary presses which are belt driven off the main press drive. While belt drives could be carried all the way to the suction drum roll such a drive is clumsy, takes up a great amount of space and permits very little flexibility. Use

GENE ROBERTS, *Engineering Department, The Manchester Machine Co., Middletown, Ohio*

FIG. 1. LAYOUT of a paper machine using a hydraulic drive at the suction roll.



FIXED DISPLACEMENT MOTOR DRIVE

A fixed displacement pump and motor make the simplest rotary hydraulic transmission. Here are a few fundamentals which help to successfully apply this transmission in many industries.

of a hydraulic drive at the suction roll provides a compact package which is easily coupled to and controlled by the main press drive. The layout drawing, Figure 1, clearly shows all the required components. Coupling the hydraulic pump to the main drive permits synchronization of the speed of the suction drum roll with the main press.

Requirements of this drive are: 1. a constant torque output over a wide speed range; 2. torque must also be adjustable over a wide range. These requirements are met by a drive shown schematically in Figure 2. The circuit with a fixed displacement pump and motor having a pressure regulator between them is analogous with the friction clutch arrangement shown in Figure 2. Adjusting spring tension on the clutch limits torque output just as adjustment of the oil pressure will limit the torque output of the fluid motor.

The hydraulic characteristics of this circuit can best be shown by the relationship of motor output torque, T, motor displacement per revolution, D, and oil pressure, P. This relationship is fixed and equals approximately 16 lb-in of torque per cubic inch displacement for each 100 psi increment of pressure—assuming 100 per cent motor efficiency. This is expressed in the formula:

$$T = \frac{DxPx16}{100}$$

where T = torque, lb-in
D = displacement, cu in/rev
P = oil pressure, psi

It can be seen from this relationship that the two requirements will be met by the circuit shown in Figure 2. With a motor having a constant displacement, torque will be held constant for a given load (pressure)

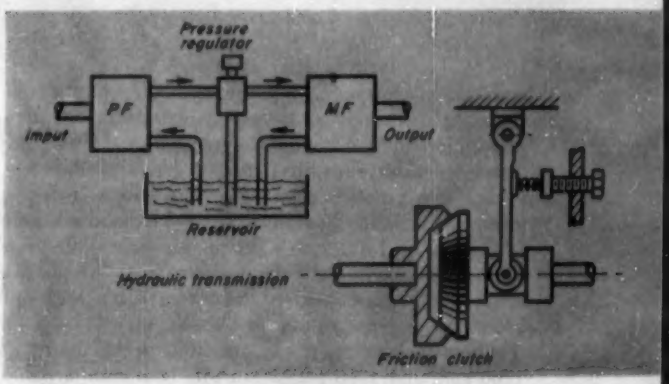


FIG. 2. TRANSMISSION of power using a fixed displacement pump and motor, and a pressure regulating valve is analogous to the mechanical friction clutch drive.

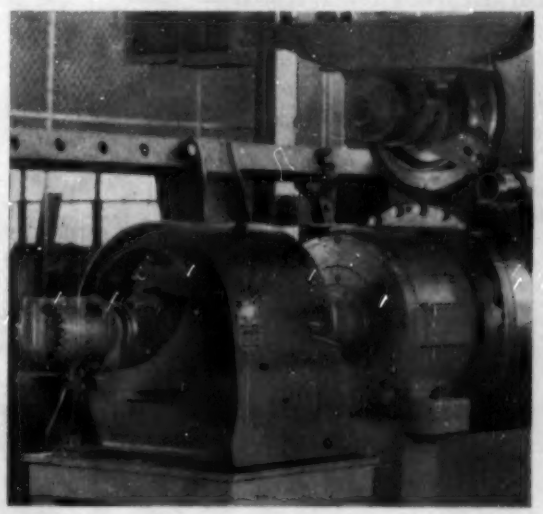


FIG. 3. CLOSE-UP of the vane type motor which drives the suction drum roll through a speed reducing gear box.

over a wide speed range. Torque can be adjusted by varying the load.

On the paper machine, the pump is driven from the pinion shaft of the main press drive, which is belt driven by a tapered pulley through a quill mounted clutch. The helper drive will then function whenever the main press drive clutch is engaged. The motor runs at a speed much greater than the roll it must drive, consequently a speed reducer is required. The selection of motor and reducer is governed by the power requirement of the roll. The pump selection is based on the fluid consumption and pressure of the motor. A pressure gauge in the line informs the machine operator of the system pressure and motor operation, enabling him to adjust the draw in the felt as he desires. The pump is driven by a chain drive from the main press pinion shaft, this gives a positive connection with the main drive.

The installation of a 30 inch diameter suction drum roll for a maximum machine speed of 400 fpm requires 10.4 hp (400 lb in torque) at 51 rpm. Knowing maximum speed, torque and power necessary at the roll shaft, the next step was to consult manufacturer's data sheets. The hydraulic motor selected is a positive displacement vane type unit. Based on data reproduced in Figure 4, this motor delivers 445 lb in torque (running torque 90 per cent theoretical at 1300 psi and requires 18.8 gpm at 1700 rpm. The motor drives the roll through a concentric gear reducer with a 32.36:1 ratio, which actually gives the motor a top speed of 1650 rpm at 400 fpm machine speed.

Since the maximum consumption of the motor at 1700 rpm and 1300 psi pressure is 18.8 gpm, a pump is selected which will deliver 25.5 gpm at 1300 psi and 1200 rpm, as shown in the data given in Figure 5. The pump is driven off the main press pinion shaft (394 rpm at 410 fpm) by a 2.67:1 ratio speed increasing chain drive. This gives the pump a delivery of 21.2 gpm at 1045 rpm maximum speed.

This hydaulic drive has several proven advantages:

1. Low initial cost
2. Simplicity of installation
3. Requires only routine maintenance which can be done by the mill's maintenance crew
4. Accurate control of torque output can be maintained.

At the initial machine speed of 200 feet per minute the drive functioned as anticipated. After more than a year of service, it has been operating successfully through the entire speed range of the paper machine.

This project was conceived and carried out under W. G. Printz, chief engineer of The Manchester Machine Company, Middletown, Ohio.

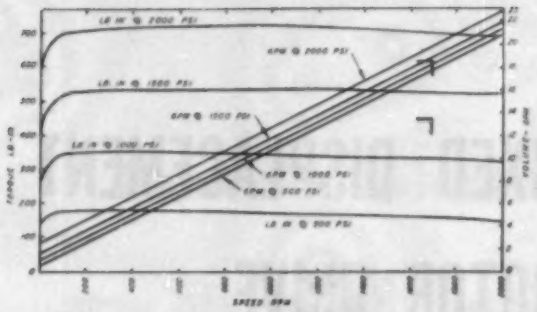


FIG. 4. FLUID MOTOR is selected by consulting performance curves. The two marked points indicate where the maximum required torque, 445 in lbs, and volume, 18.8 gpm, fall on these curves.

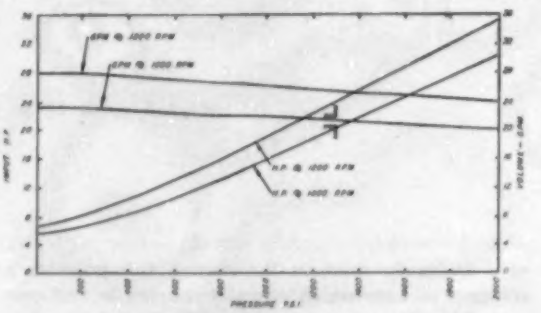


FIG. 5. PERFORMANCE curves for the pump show horsepower input, 20.5 hp and pump delivery, 21.2 gpm, at the maximum pump speed, 1045 rpm, on the paper machine.

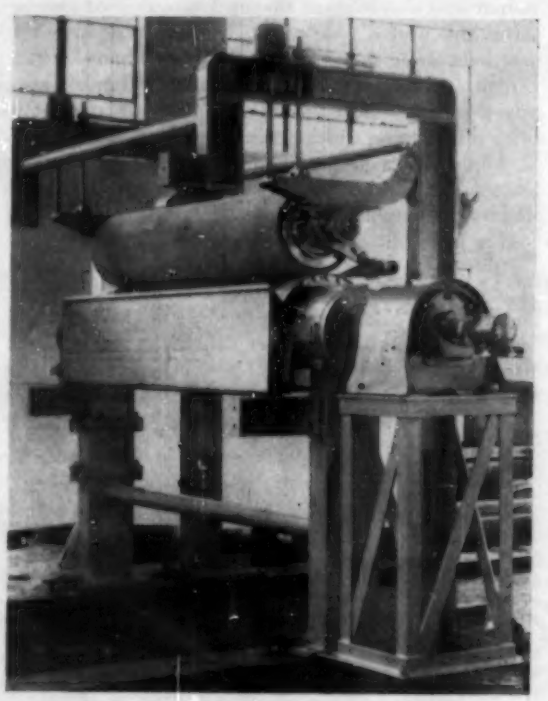
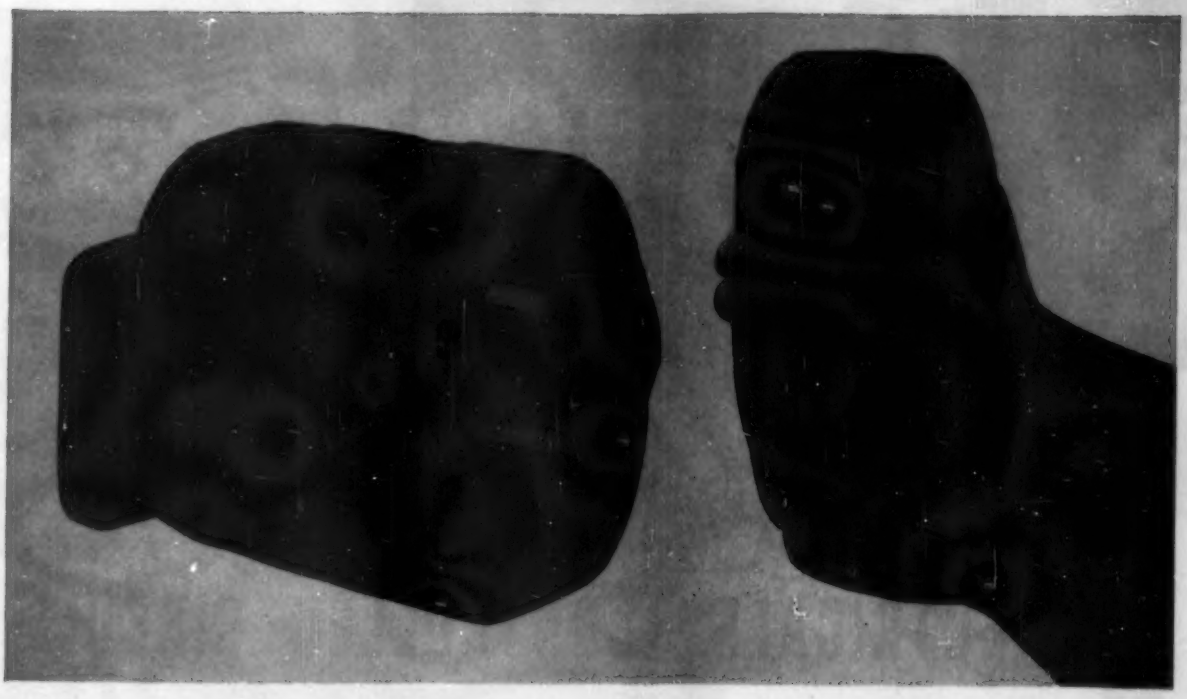


FIG. 6. VIEW of the hydraulic helper drive mounted on the suction drum roll. The 30 inch roll is driven at a maximum surface speed of 400 fpm.



Power Packed "Commercial" Hydraulic Pump Keeps Snow Fighters Moving

THIS HEAVY DUTY service "Commercial" double hydraulic pump will develop fluid power to flex the muscles of the fluid motors which operate the brush equipment mounted on this tractor. The entire mounting is as clean as the cleared road which is left.

Two separate pumps, assembled into a single unit, are driven by one through shaft to which the primary driving power is applied. Safe operating pressures up to 1500 p.s.i. can be developed with one pump having ample capacity to raise and lower the cylinders, while the other pump maintains uninterrupted rotation of the fluid motor which turns the brush.

Here again is an application of fluid power controls giving a simplified, lower cost installation when compared to any other method of power transmission. You will find that there are "Commercial" oil hydraulic pumps, motors, valves, and cylinders giving dependable service and working near you.

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KA-62

HYDRAULIC CYLINDERS which operate the toggle mechanism at the instrument section of the shock tube are seen in this overall view of the test chamber.

Shock Tests Made Safer with ELECTRICALLY CONTROLLED CIRCUIT

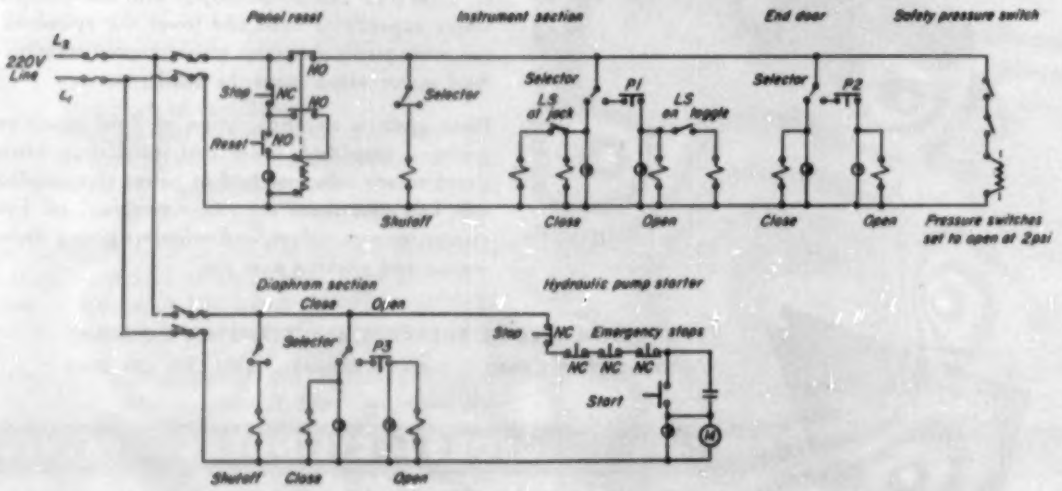
• By Walter Herrmann, Vaughn L. Beals, Jr. and Emmett A. Witmer

BECAUSE of the need for remote stations and for a positive "fail-safe" system, designers of the Shock Tube Facility at M.I.T. use electrically-actuated valves on a hydraulic locking and positioning circuit. This job* is one of the many interesting projects being carried on by the Aeroelastic and Structures Research Division at Massachusetts Institute of Technology.

The shock tube is a device for generating shock

WALTER HERRMANN, VAUGHN L. BEALS, JR. *and* EMMETT A. WITMER, *Engineers, Aeroelastic and Structures Research Laboratory, Department of Aeronautical Engineering, Massachusetts Institute of Technology, Cambridge, Mass.*

**Developed under Air Force Contract AF33 (038)-8906 for the Aircraft Loads Division of the Wright Air Development Center. This contract work was carried out under the academic supervision of Professors H. B. Stever and R. L. Bisplinghoff.*



ELECTRICAL CONTROL CIRCUIT for hydraulically-powered motions on the shock tube installation.

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Surprisingly low in cost, the P-237 Pump combines top efficiency with weight-saving compactness. This is a 6-piston, wobble plate pump with 15 hp intermittent capacity — it's quiet, vibrationless and serves an infinite variety of loads and speeds. Proof of its outstanding performance can be found in many successful applications on machine tools, construction, mining, agricultural and other machinery.

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A Blackhawk hydraulic control expert will be glad to analyze your requirements.

See Sweet's Product Designer's File

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The P-237 Pump is used in the famous "Hydro-Hoe" pictured here. Blackhawk design helps hundreds of manufacturers save materials, reduce assembly time, create new sales appeals and build customer satisfaction.

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ELECTRICAL CONTROL ADDS SAFETY

waves in air or other gases and is being used to study the effects of shock and blast waves, and the transient aerodynamic flow buildup on structures of various types. Accompanying photographs show the shock tube which is nearly 100 feet long and has an inside section measuring 8 by 24 inches. The tube is divided into a compression and an expansion section at roughly a third of its length by a plastic diaphragm. This 30 foot long compression section is pumped up to a pressure higher than the expansion section, and the diaphragm is punctured setting up a shock wave which proceeds down the expansion chamber. Models are placed between glass windows at the instrument section which is located two-thirds of the way down the expansion chamber. This tube has been designed specifically for high Reynolds Number work, which implies high operating pressures. A Reynolds' Number of 5 million may be obtained over a wide range of test conditions.

Hydraulic power was selected to open and close the shock tube at both the diaphragm and instrument sections; to clamp the tube sections closed at the diaphragm against an internal air pressure of 250 psi; and to open and close a door at the end of the tube. To open and close the tube at the diaphragm section requires rolling, on rails the 30 foot long fabricated steel sections comprising the compression chamber, which altogether weigh about 5 tons. Clamping the compression section to the expansion section requires a force in excess of 25 tons.

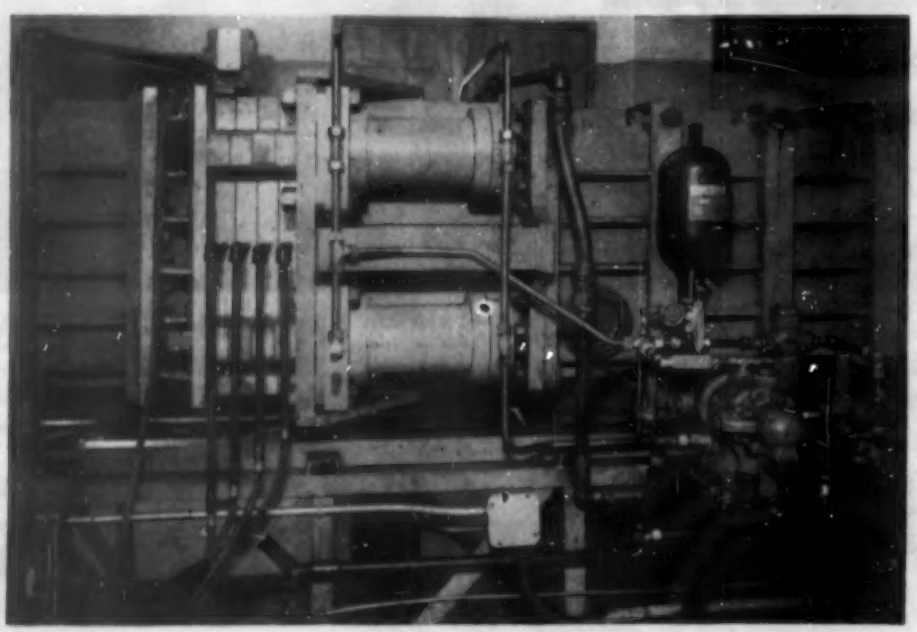
All the cylinders in the system are powered by oil from a variable volume vane pump which delivers a maximum 12 gpm to the system. At the diaphragm section four, six inch bore cylinders open, close and clamp the sections. A 3:1 reciprocating booster is in the clamp circuit to boost the 700 psi, which the pump is set to develop, up to 2100 psi. A one gallon accumulator was put in the circuit to maintain the clamp pressure in case the pump shuts off.

Direction of cylinder travel is controlled by two-position double-solenoid valves. In all cases, the solenoids are held energized by selector switches which make control relays unnecessary. Because hand-positioned selector switches are used, one might well ask why manually operated hydraulic valves weren't selected. Although the electrical control is simple, it provides safety interlocks which would be difficult to assure with manually operated valves. For example, pressure switch contacts in each of the three operating devices open to prevent the "cylinder open" solenoids from operating when there is more than 2 psi air pressure in the shock tube. Electrical control also permits operation from a conveniently situated central control panel.

The pump motor control circuit has three emergency stop buttons located to permit pump shutdown from stations at the diaphragm section, instrument section and end door. To make it possible to stop the opening or closing action of any cylinder at any point in its travel, without stopping the pump, 2-way normally-open shut-off valves are placed in the circuit.

At the instrument section, it is necessary to provide a clamp mechanism and also a jack cylinder to roll back the expansion section of the tube and thereby permit necessary placement and work on models or instruments needed to set up a test. On opening of the section, a limit switch is used in this circuit to initiate jack-cylinder action only after the cylinder operated-toggle operates.

Hydraulic power takes the effort out of moving and clamping these heavy test sections. Electrical control adds the necessary safety and ease of operation.



RECIPROCATING BOOSTER supplies high pressure to the cylinders which clamp the expansion and compression sections of the tube. An accumulator holds the clamping pressure.

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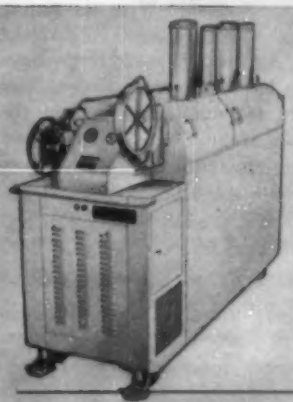
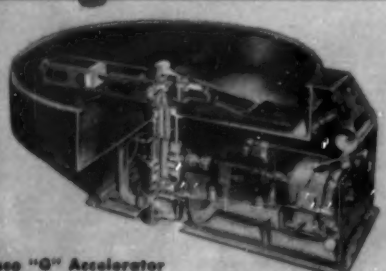


Motion Picture Film Processing Machine By Houston Fearless Corp.—Another application where stepless variable speed and constant torque of Vickers Hydraulic Power Transmission provided much more satisfactory operation.



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1954 Fall Meeting of the NATIONAL FLUID POWER ASSOCIATION

THE National Fluid Power Association held its 1954 Fall meeting at the Hotel Commodore, New York, on September 7, 8 and 9. A total of 92 representatives of the more than sixty member companies and guests heard reports in the busy, productive "working" program. Excellent progress was made in both the Product Section and Operating Committee meetings.

The first day was given over to registration, a board of directors' meeting and special meetings of the Cylinder Section and the Educational Committee. Other sections and Operating committees also held informal meetings and discussions.

President B. N. Ashton presided at a general assembly on the morning of the second day. E. G. Peterson read the Treasurer's Report and Barrett Rogers the Executive Secretary's report. Vice President J. E. Erskine outlined the changes that had been made in the internal organization of NFPA, including the present six Product Sections and seven Operating Committees. Vice President O. Wendell Macy introduced the chairman of the Operating Committees, who in turn gave progress reports. Ernst Weidmann reported on the Design Committee, J. C. Hanna on the Education Committee, R. W. Peterman on the Fluids Committee, W. J. Kudlaty on the Ratings Committee, Ernst Weidmann on the Symbols Committee and R. H. Davies on the Terminology Committee.

President B. N. Ashton presiding at a general session of NFPA Fall meeting.

In the afternoon lively discussions were developed at meetings of the Product Sections. With the influx of new members into NFPA, the original three Product groups have grown into six. Hyman Ledeen lead a very informative session in the Cylinder section. F. G. Kuhagen presided over the Pump section and L. L. Charlson chairmanned the Valves section. These were the original product groups. In addition D.

Chairman R. W. Peterman (second from right) listens to a point being made by A. W. Salzman in the Fluids Committee meeting.

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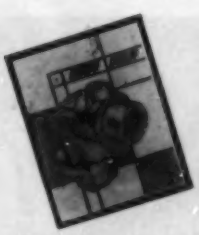

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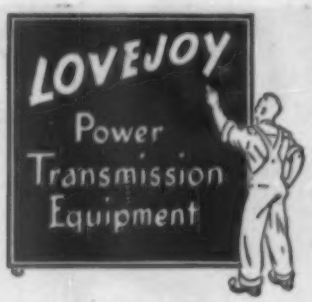

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A. Cameron led the Conductors and Connectors section meeting; E. F. Noyes the Packings and Seals and E. M. Greer the Related Components section meetings.

On the third day the entire morning was given over to Operating Committee meetings. These committees are made up of representatives of all types of equipment, representing industry-wide functions, with membership from product sections. For example the Education Committee, under the chairmanship of J. C. Hanna, is made up of representatives from all product sections, since the NFPA Educational program is based on industry-wide requirements. Some of the Operating Committees were able to work with detailed preliminary reports submitted by the chairman to the entire NFPA the day before, others perfected their working agenda and broke the committee work down into sub-committees. The Government Relations committee, for example, was able to setup a number of definite suggestions for the Bureau of the Census, which is just beginning to work on the next census of Business, Manufacturers and Mineral Industries; a sub-committee was appointed to present these suggestions in person to the Bureau of the Census very soon.

At luncheon retiring president J. C. Hanna was presented with an inscribed tray, a gift of the members of the board.

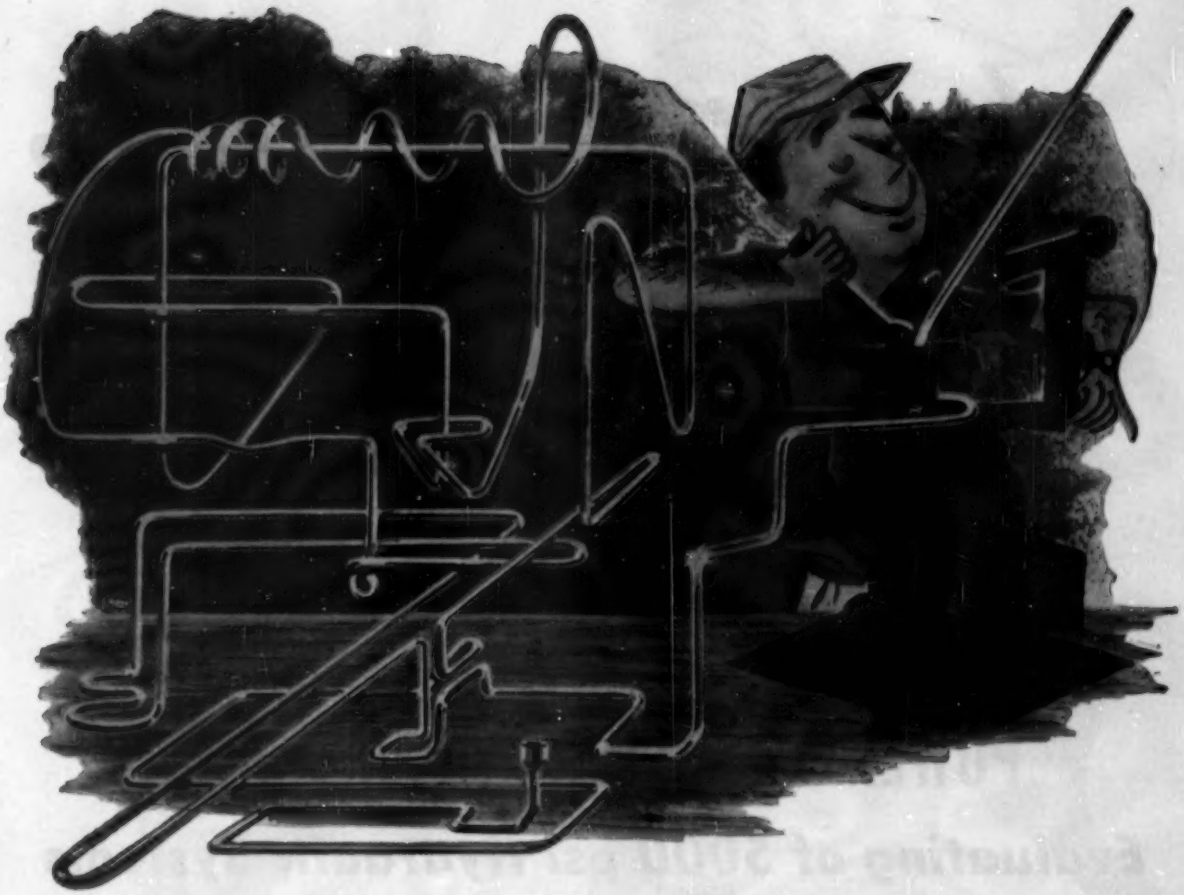
In the afternoon, with President Ashton in the chair, brief reports on the work accomplished in both the Product Sections and Operating Committees were given. The selection of an insignia for NFPA was postponed until the spring meeting.

Four new members were admitted to NFPA: Chicago Rawhide Manufacturing Company, Hydro-Line Mfg. Co., Valvair Corporation and Mead Specialties Co., bringing the total membership to 65 companies.

The 1955 Annual meeting will be held in Colorado Springs, April 5, 6 and 7.

The Ratings Committee, with W. J. Kudlaty in the chair, discuss component ratings referred to them by the Product Sections.

Chairman J. C. Hanna of the Education Committee and his committee make good progress on the industry-wide training program being set up for their own company personnel, their dealers and their customers.



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"POWER IN A SMALLER PACKAGE"

Evaluating of 5000 psi Hydraulic Systems

Last month, the potential advantages of a 5000 psi pneumatic system were discussed. Here's a comprehensive study of high pressure hydraulics applied to aircraft.

● By Joseph N. Steinmetz, Jr.

IN line with the present trend toward increasing performance of modern jet aircraft, and airliners as well, it will be of interest to many in the field of applied hydraulics to review the possibility of higher pressures for aircraft hydraulic systems. This has as a primary object the packing of a greater amount of horsepower into a smaller package. The purpose of this article is to review the state of the art as it now stands, and to discuss both the advantages and the disadvantages of such a development. It is apparent that an increase in pressures will be accompanied by a great many problems, and it is reasonable to assume that the hydraulics engineer will want to examine the potential benefit before taking the step. With this in mind, the author has included a number of drawings, calculations and estimates for typical aircraft hydraulic systems. These should be of assistance for preliminary evaluation and estimating. It is recognized that a rigorous analysis is not possible without a more accurate definition of the system and its components.

At the present time, the British are also interested in the development of higher pressures. According to an article appearing in the November 1953 issue of APPLIED HYDRAULICS, the Bristol Britannia Turboprop Airliner is now in production with a 4,000 psi hy-

JOSEPH N. STEINMETZ, JR., *Hydraulic Group Consolidated-Vultee Aircraft Corporation, San Diego, Calif.*

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draulic system. The system is powered by four hydraulic pumps, each rated at 3 gpm and 2500 rpm. American interest is apparently centered to a greater extent upon the development of hydraulic pumps which are capable of higher speeds and higher temperatures, however the SAE A-6C Sub-committee for Aircraft has asked for data covering 5,000 psi test circuits, and at the present time is considering a proposed specification for a 5,000 psi variable delivery hydraulic pump. Undoubtedly the most important single item contributing to an increase in hydraulic pressures is the development of a suitable aircraft type pump. The development of a 5,000 psi hydraulic system will permit a substantial saving in the total volume of the system, and our calculations indicate that the actuators are undoubtedly the largest single source for space and weight saving. The balance of this article will be devoted to a discussion of specific components, specific problems, and a summary of the advantages and disadvantages.

ACTUATORS

One of the more important objections to the use of higher pressures in actuators concerns itself with the performance of the hydraulic dynamic seals. Pressure increase to 5,000 psi will cause rapid strain aging and extrusion of the conventional "O" ring seal, with resultant leakage and poor service life of the moving seals. To overcome this difficulty, the actuator may be designed for a controlled amount of seal leakage as shown by Figure 1. This figure is a schematic drawing which shows a double seal at the shaft end of the cylinder. The inner seal is of spiral teflon or other suitable high pressure seal which will give good service life at 5,000 psi, except that a certain amount of leakage must be tolerated. This small amount of flow is directed to return by means of the drain line and check valve as indicated. The outer seal pressure will be equal to the return line back pressure, so that an "O" Ring may be used here. The piston itself is fitted with steel piston rings. This is a well known type of dynamic seal, suitable for the higher pressures. A small amount of leakage must be permitted, however the present experience with the use of steel piston rings in 3,000 psi surface control actuators in jet aircraft indicates that the leakage across the rings does not have any noticeable effect on the operation of the cylinder. The cylinder walls should be hardened in order to prevent scoring. Figure 1 is merely an indication of one approach to the problem, and it is included because it is felt that the engineering of the dynamic seals will require the greatest amount of attention in the development of high pressure actuators.

Why use a 5000 psi system?

ADVANTAGES	DISADVANTAGES
Approximately 20% total space saving for the complete system.	A new approach to sealing problems is indicated in order to insure the reliability of the system.
Approximately 30% space saving for actuators.	Very large costs are involved for the development of components, systems and support equipment.
Approximately 8% total weight saving for the system.	Design temperatures are becoming more and more critical for jets. Higher pressures will result in an undesirable increase in hydraulic fluid temperatures. Development is required toward the solution of the flexible hose problem.
Change is consistent with the increasing density of modern jet aircraft.	Potential increase in external leakage will require much attention.
Aerodynamic cleanliness is improved by reduction in size of surface actuator housings.	Service life of the pumps may have to be reduced.
The next pressure increase should remain standard for a great many years, at least until vastly improved materials or completely new design concepts are developed. This is because greatly diminishing returns would result from further increases in pressure.	

ACTUATOR PROPORTIONS

Figure 2 was prepared to show the effect of increasing hydraulic pressures on cylinder proportions, for a typical landing gear cylinder. The views are drawn to scale in order to compare the size of the cylinders at 3,000, 5,000, and 7,500 psi with the load remaining constant at 12,350 pounds. The 7,500 psi pressure is considered also in this article in order to

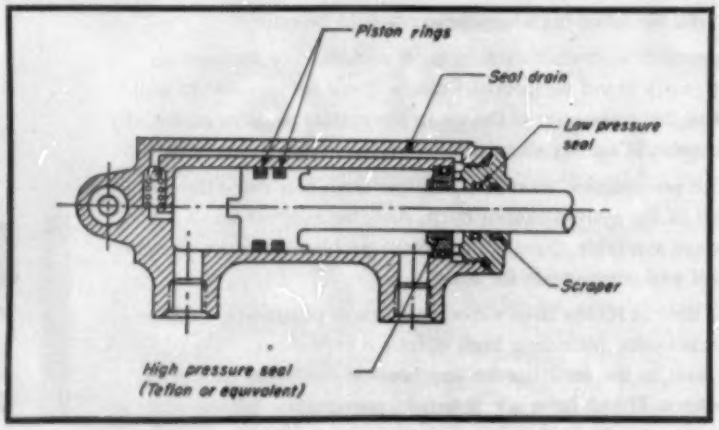

FIG. 1. SEAL DESIGN is a major problem in high pressure cylinders. This cylinder drawing shows one approach to the seal problem. Between the high and low pressure seal, a small amount of necessary leakage is drained back to the return.

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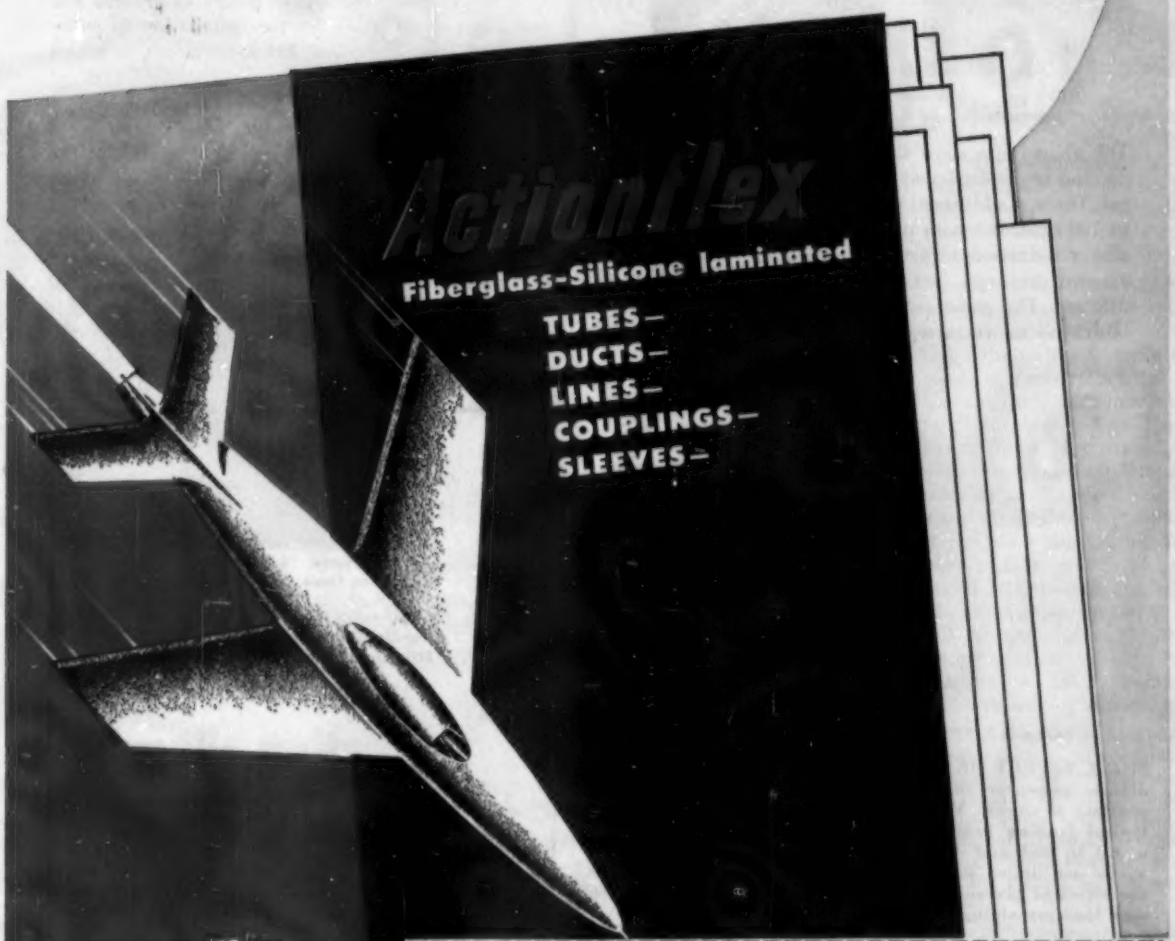

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get an estimate of the feasability of even higher pressures. A study of the data listed on Figure 2 leads us to several interesting conclusions, as follows:

1.

Pressure	Displacement Ratio	Weight Ratio
3000 psi	$\frac{61.5}{61.5} = 1.00$	$\frac{13.0}{13.0} = 1.00$
5000 psi	$\frac{39.3}{61.5} = .64$	$\frac{12.2}{13.0} = .94$
7500 psi	$\frac{30.0}{61.5} = .49$	$\frac{11.9}{13.0} = .91$

The above data show that we get a substantial reduction in displacement in going from 3000 to 5000 psi. There is additional reduction in volume in going to 7500 psi, but with diminishing returns. There is also a reduction in actuator weight due to the increased pressures, but the reduction is not so significant. The same pattern of diminishing returns is evident as we increase the pressures.

2. Another interesting factor is the unbalance which is obtained between the extension force and the retraction force, due to increasing pressures, as follows:

3000 psi ratio = 1.20
5000 psi ratio = 1.27
7500 psi ratio = 1.45

This shows that the increase from 3000 to 5000 psi has only a slight effect on the increase in the ratio, whereas the 7500 psi increase in pressure produces a rather large difference between the extension and retraction forces, for this cylinder.

3. It is clear that the higher pressures provide less space in the actuators for the installation of snubbers and locking devices, for applications in which these are required.

Another approach to the study in proportions is shown by Figure 3. This figure shows the effect of doubling up on the load and halving the arm, at the same time increasing the pressure to 5000 psi. This figure is also drawn to scale in order to provide a visual estimate of the benefit. The 3000 psi cylinder is a typical dual system, tandem-type control surface actuator designed to provide a hinge moment of 98,700 in. lb. for control surface operation. A 7 inch arm is required in order to do the work required of this 3000

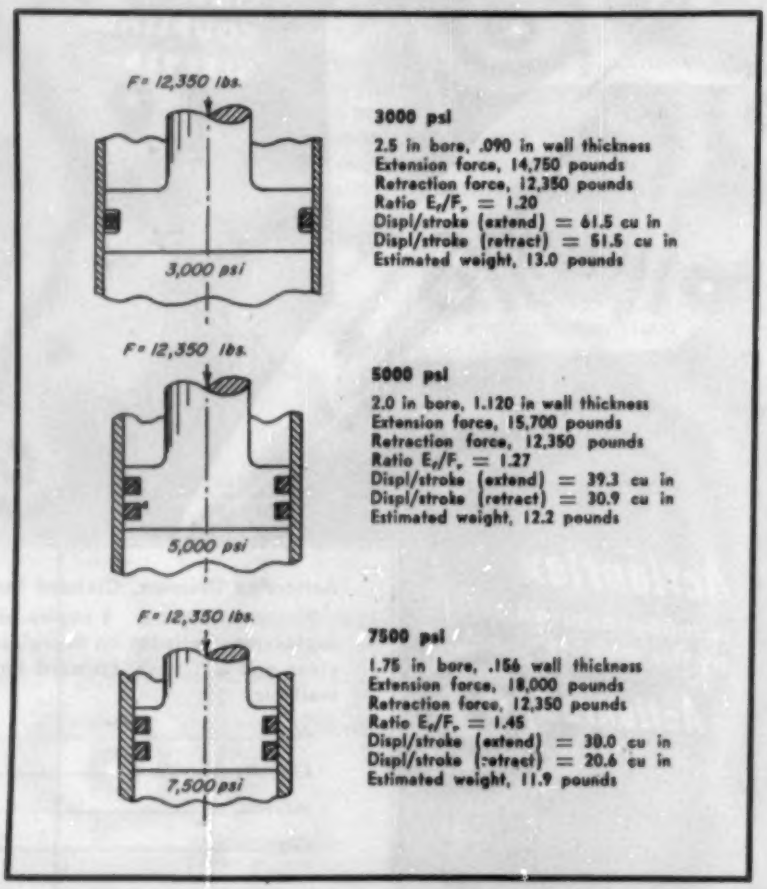
F = 12,350 lbs.
3,000 psi
3000 psi
2.5 in bore, .090 in wall thickness
Extension force, 14,750 pounds
Retraction force, 12,350 pounds
Ratio E_r/F_r = 1.20
Displ/stroke (extend) = 61.5 cu in
Displ/stroke (retract) = 51.5 cu in
Estimated weight, 13.0 pounds
F = 12,350 lbs.
5,000 psi
5000 psi
2.0 in bore, 1.120 in wall thickness
Extension force, 15,700 pounds
Retraction force, 12,350 pounds
Ratio E_r/F_r = 1.27
Displ/stroke (extend) = 39.3 cu in
Displ/stroke (retract) = 30.9 cu in
Estimated weight, 12.2 pounds
F = 12,350 lbs.
7,500 psi
7500 psi
1.75 in bore, .156 wall thickness
Extension force, 18,000 pounds
Retraction force, 12,350 pounds
Ratio E_r/F_r = 1.45
Displ/stroke (extend) = 30.0 cu in
Displ/stroke (retract) = 20.6 cu in
Estimated weight, 11.9 pounds

FIG. 2. EFFECT OF VARIOUS hydraulic pressures on cylinder proportions is shown. Views are for a typical landing gear cylinder with a 1.0 in rod and 12.5 in stroke. Views are drawn to scale to show the effect of pressures with the design load remaining constant.

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Despite cleanliness and efficiency of a midwest firm's Plastic Division, shown above, there was "dirty work" afoot in the hydraulic systems of the injection molding machines. Division superintendent (left) and A. L. Seabaugh, of Standard Oil, came up with a solution.

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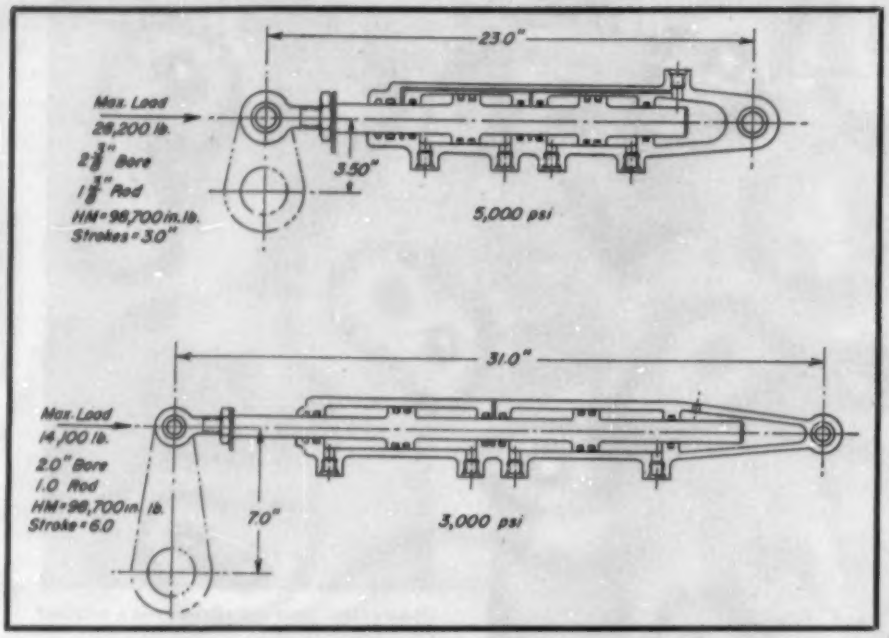

FIG. 3. USING 5000 psi instead of 3000 psi permits reduction of the hinge arm and considerable reduction in the size of the actuator housings.

psi cylinder, and a 6 inch stroke is required in order to obtain the desired surface deflection.

It is evident that we can cut the stroke and the arm by half, provided we can double the load. This may be acomplished by increasing the rod, the bearings, the bore and the pressure as shown by Figure 3. A considerable shortening of the cylinder results, and the outside diameter is only slightly increased. Here is a case where a great deal of advantage can be gained by reduction in the size of the actuator housings, which is of paramount importance from the standpoint of drag reduction. Figure 3 was drawn to show that the actuator housings can be reduced to a fraction of their former size, through the use of increasing pressures.

MACHINING OF THIN WALLS

The wall thickness of a 3,000 psi hydraulic actuator must be increased beyond the theoretically safe stress to allow for practical problems such as concentricity, warpage, imperfections and other variables in the machining process. The thicker walls required by higher pressures provide somewhat more favorable machining conditions, and the wall becomes more efficient because the "overhead" allowance for imperfections becomes a smaller percentage of the total thickness.

DYNAMIC SEALS

In connection with the dynamic sealing problem, it should be stated that there are numerous cases in which the conventional "O" ring seals have been used successfully for higher pressures, in some cases greatly exceeding even 5,000 psi, but these are ideal cases. In general, a dynamic "O" ring seal has limited service life, and premature failures are occasionally noted even at 3,000 psi. It is reasonable to expect that there would be many more failures at 5,000 psi, with a consequent reduction in the reliability of the system. It is for this reason that other types have been emphasized in this article. Many engineers would be glad to exchange the small amount of leakage required by other types of seals in exchange for good reliability and excellent service life.

HYDRAULIC PUMPS

A number of hydraulic pump manufacturers have already gotten into the field of higher pressures, with fairly encouraging results. Some aircraft types are being tested, and commercial types of 5000 psi rating have been available for some time. The June 1954 issue of APPLIED HYDRAULICS report of the SAE Aviation Committee meetings indicates some of the work which is now being done on the preparation of specifications covering high speed, high temperature, and high pressure pumps of various types, including variable delivery. It is interesting to note that a 14 gpm pump at 5000 psi will provide the same horsepower output as a 20 gpm pump rated at 3000 psi. This reduction in volume is similar to the reduction in actuator displacement, and it is apparent that the volume of the entire system can be substantially reduced, including pumps,

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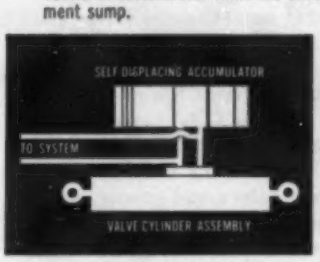
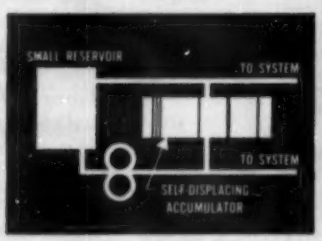
Bendix-Pacific Self-Displacing Accumulators can eliminate serious operational handicaps in remote installations and in closed surface control systems.

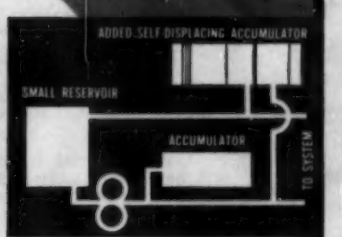
The Accumulators incorporate double chambers and double pistons joined by a piston rod. Half the unit operates as a conventional accumulator while the second half acts as a displacement sump.



For remotely located hydraulic valves which require sudden changes in rates of flow, the problems of large lines, weight, hydraulic hammer and pressure drop are virtually eliminated with the new Accumulator. It is located close to the control valve, resulting in much **faster action** and less pressure surges because the return oil travels a minimum distance.



Use of the Bendix-Pacific Self-Displacing Accumulator in an independent, completely closed hydraulic system simplifies the reservoir problem. Instead of designing a pressurized reservoir capable of accommodating the full displacement of the accumulator, it is merely necessary to provide a reservoir capable of handling expansion of the fluid, plus piston rod displacement, if any.



In systems already designed which require the addition of an accumulator, use of the Bendix-Pacific Self-Displacing Accumulator may eliminate reservoir redesign as the total system volumetric change remains the same.

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reservoirs, actuators, line sizes and possibly certain other components of the hydraulic system.

FLEXIBLE LINES AND HOSES

The engineering of flexible connections is a major problem in the practical application of high pressure systems. The present hoses are bulky and are definitely limited as to pressure rating, especially when subject to impulse cycling. Much development is being done along these lines, including some work on metal braided hoses, but at the present time the indications are that other methods will have to be studied for pressures on the order of 5000 psi. The engineering of designed motion in tubing, and the use of swivel joints are alternatives which are used occasionally in certain applications. The smaller tubing sizes which can be used in a 5000 psi system will ordinarily reduce the stress obtained through the use of designed motion in tubing.

LEAKAGE

One of the frequently stated objections to the higher pressures is the increase in leakage. In the case of the dynamic seals the leakage can be controlled as has previously been stated. The present standard flared tubes and other static seals are capable of holding the zero external leakage requirement, but it is evident that a greater amount of care and quality control will be necessary in order to keep this problem to a minimum.

VALVE DESIGN

Increasing pressures in valve design suggests a general trend toward the use of metal-to-metal valves and seats as is now accomplished by optical flats and lapping operations. These valves are higher in initial cost, but have a more satisfactory service life than is obtained with sliding "O" ring seals. In many designs the sealing quality is actually improved with usage. More attention to the filtering of the hydraulic fluid is required for most of these valves, and greater use of integral filters is indicated. Servo control valves will be required to meter considerably smaller quantities of fluid due to reduced displacement of the actuators.

PROPERTIES OF THE FLUID

Certain changes in the properties of the fluid with increase in pressure are itemized below. The behaviour of the hydraulic system will be affected to some extent by the changes in physical characteristics.

1. Kinematic viscosity increases. USAF Report 5997, June 1950, indicates that the ratio of kinematic viscosity at 3000 psi to that at atmospheric pressure is 1.4 at 200 F and 1.92 at −40 F.
2. Air solubility increases. At 3000 psi the solubility is 27 vols. air/volume oil, and at 5000 psi the solubility is 55 vols air/volume oil. The above values are for a petroleum fraction similar to hydraulic fluid.
3. Density increases slightly. The ratio of the densi-

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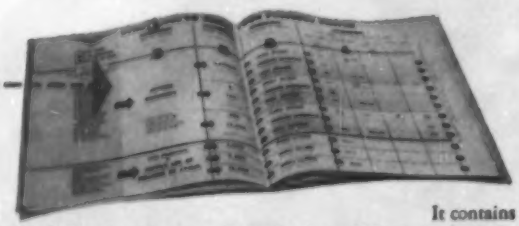

It contains a simplified chart for pressure switch selection, which sheds new light on a subject shrouded in mystery.

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ty at 3000 psi to that at atmospheric pressure is 1.012 at 100 F., and at 5000 psi the ratio is 1.020 at the same temperature.

THERMAL PROBLEMS

The temperature increase of the fluid due to leakage across seals and pump pistons amounts to about 32 degrees for fluid at 5000 psi, and about 16 degrees for fluid at 3000 psi. This increase, plus the fact that more leakage past the pump pistons and various internal seals is indicated for the 5000 psi system will cause an increase in the maximum temperatures of the fluid. Vapor pressures for MIL-0-5606 hydraulic fluid have been established at the following values from Shell Oil Company tests:

Temp. °F	Pressure, psi
294	83.0
272	49.2
254	33.0
230	18.2
194	7.9

Critical temperature maximums will probably become marginal for most applications of 5000 psi systems in jet aircraft, and this problem will have to be met with coolers, unless the silicate-ester or other suitable high temperature fluid becomes available.

SERVICING, TEST AND INSPECTION EQUIPMENT

In order to support the aircraft, numerous pieces of servicing, test and inspection equipment are required. Much of this equipment can be modified for the higher pressures, and some of it is already adequate. Pressure multiplying cylinders can be installed to provide static proof pressures. Modification and installation of higher pressure service and test equipment which is suitable for the purpose will be a major cost item, and the procurement and installation can be expected to require years before it is generally available. The cost of the development of higher pressures in aircraft hydraulic systems and related equipment must necessarily be evaluated in terms of the expected improvement in the performance and the new design requirements of the aircraft. The dollar consideration ordinarily becomes secondary, however, to any clearly demonstrable design improvement, at least for high performance military aircraft.

Engineers interested in comprehensive analyses of high pressure systems should refer to WADC Technical Report 54-189, Vols. 1 and 2, "Theoretical Investigation of Optimum Pressures in Aircraft Hydraulic Systems" dated January 1954 (Unclassified).

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In addition to this unusual equipment the plant contains a multitude of turret lathes, hand screw machines, automatic screw machines, engine lathes, drill presses—some automatic indexing, large radial drills, boring machines, shapers, and planers. Complete qualified facilities for arc, oxy-acetylene, and heli-arc welding of steel and aluminum are provided.

These facilities make Loud an outstanding source for major sub-assemblies of aircraft.

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SYMPOSIUM ON AIR

HIGH TEMPERATURE STA

The Symposium on Aircraft High Temperature Static Seals for All Media, sponsored by SAE Committee A-1, Joint Aircraft Engine and Accessory Installations, held at the Hotel Statler, Cleveland, May 18-19, represented an unusually complete cross section of the current thinking of representatives of the aircraft and its supply industries on this critical problem. Since the AE-1 Committee is made up of specialists of engine, aircraft, aircraft accessory equipment and airline companies, practically the entire group of persons interested in the technical problems of high temperature are represented. The group of papers, several of which are abstracted below, have been assigned and prepared with the expectation that the state of the art in high temperature seals, not previously defined sufficiently to allow the preparation of an aeronautical recommended practice (ARP), could be definitely clarified and advanced.

The AE-1 Committee set up a panel of five members: R. F. Schwarzwalder, E. J. Bodensieck, E. A. Droegemueller, E. Pfafman and B. R. Teree, with the last named as chairman. Mr. Teree made most of the arrangements, with the assistance of other members of the panel, for the symposium.

A total attendance of approximately 200, far more than anticipated, attested to the importance which the entire industry, including the Services and suppliers, attached to the subject.

V. W. Peterson, Allison Division of General Motors Corporation and a member of AE-1, began the symposium with a brief statement of the objectives of the two day meeting. He pointed out that existing industry and military standards on static seals, particularly of the rubber "O" ring type, have given good coverage up to the temperature range of 250 F, but that beyond this temperature standardization was lacking. The AE-1 Committee had taken an initial step toward standardization in the form of an ARP. However, with so many types of seals being considered and the lack of general experience with many of them, made it apparent that the art was too much in its infancy to even arrive at an ARP. The symposium was considered the next best step since it offered an immediate interchange of the available information and experience. The discussions, for the purpose of pointing toward standardization, was limited to the performance of packing materials and seal designs for exposure to the following conditions: temperature - 250 F to 1500 F; pressure - fuel 0 to 400 psi; oil 0 to 600 psi; air 0 to 1000 psi; fluids, including all aircraft and guided missile fuels and lubricating oils to include mineral oils and a number of synthetic oils (sedacates, polyglycols, adipates, silicones and azelates).

● *Materials for High Temperature Fuel and Oil Resistant Seals*

By H. C. Hamlin, Major, USAF
Wright Air Development Center

Major Hamlin outlined the research projects that have been carried on in the Materials Laboratory, particularly with elastomers, pointing out that high temperature requirements for both organic and inorganic polymers have taxed the ingenuity of the rubber compounder to the limit.

A number of synthetic lubricants now in use in jet engines have an undesirable effect on rubber at elevated temperatures. Examples cited included aging of a Buna N and a polyacrylate compound in a MIL-L-7808 type lubricant in tests conducted at 350 F. The Buna N com-

CRAFT TIC SEALS

pound had an ultimate life of approximately one week when the immersion media was open to the air. When operated in the absence of oxygen, the stock was in excellent condition after 500 hours. The polyacrylate compound went the full test period without cracking although not without considerable softening and excessive swell.

A number of silicone compounds tested at 300 F and at 350 F exhibited volume swells of from 20 to 80 percent at 300 F with comparable loss of physical properties. Long time aging at 300 F and short time aging at 350 F gave results indicating a gradual solution of the rubber. The conclusion was that silicone rubber should be used in such lubricants with great caution, if at all.

For service above 500 F and where low temperature properties may be virtually ignored, the polyacrylate rubbers such as Hycar 4021 and Acrylon EA-5 have been studied. An Acrylon EA-5 compound developed especially for this purpose and tested at 550 F had a very short life. One airplane manufacturer tested a similar compound and reported it fairly practicable.

Most Neoprene W compounds and Acrylon compounds will not give similar results.

Two recently developed experimental materials have exhibited unique characteristics and may help solve some rather knotty problems.

The first of these is a vulcanizable elastic form of KEL-F, known as KEL-F Elastomer. Compounded into a strong, moderately elastic rubber with good fuel and oil resistance, excellent dry heat aging and good, relative resistance to fuming nitric acid, this material shows promise. Early studies indicate that KEL-F Elastomer has good properties for use with silicone oils when used

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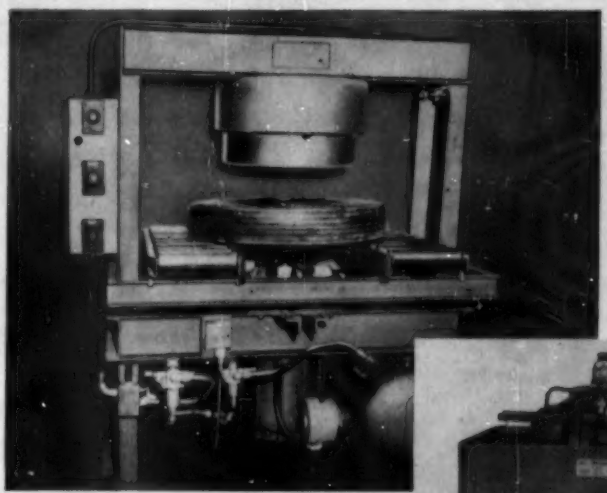

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as a lubricant or as a hydraulic fluid up to at least 400 F.

The other experimental elastomer, the result of an Air Force sponsored research project at Minnesota Mining and Manufacturing Co., is a highly fluorinated polyacrylic ester, commonly called poly FBA. Originally developed in a search for a low temperature fuel resistant rubber, poly FBA was a partial failure because of its typical acrylic brittleness at or near 0 F. Development disclosed that it was actually a fairly promising high temperature rubber when properly compounded. Its resistance to synthetic diester lubricants at 350 F and up was particularly encouraging.

A considerable study has been made of the effect of MIL-L-7808 type lubricants on poly FBA vulcanizates. The effect of aging two poly FBA vulcanizates in Esso Turbo Oil 15 at 350 F at periods up to 500 hours, at 400 F for 265 hours and at 500 F for 24 hours has justified further development. A FBA compound has withstood immersion in a silicate ester fluid (MLO 8200) for 5 hours at 500 F.

The problem of developing rubber compounds to function successfully in the fantastically severe environmental conditions, both imposed by current designs and proposed by future designs, presents a real challenge to the rubber technologist and the polymer chemist. A number of new materials, several with many excellent properties, have been developed. Others, like poly FBA, have mechanical characteristics quite unlike the conventional synthetics. Some of the experimental elastomers being tested at present are rather sluggish at room temperature, but above 200 F or more are quite snappy and elastic. There is evidence that materials can be made which would be quite elastic at temperatures up to and beyond 700 F, although when cooled to room temperature they would be resinous solids.

The designer using elastomeric materials has as big a stake in the solutions to these problems as anyone. It should be very useful to know just what factors affect the life of an "O" ring seal in a given environment and in what direction. Excellent work, already reported, appears to be pointed toward a specific phase of the problem. Additional work seems desirable to correlate existing data; particularly basic data on such factors as variation in modulus, hardness and volume of change of rubber are needed, as well as coordinated information on the effects of groove or channel shape and size, confinement of the ring, back up support and, probably, other factors not as yet identified.

Definite progress has been made in the development of new elastomers and practical compounds therefrom. Several new and promising materials with attractive high temperature and chemical resistance properties are on the horizon or in the pilot stage. New elastomers, as well as rubber in general, depends largely on close cooperation between the polymer chemist, the rubber processor and the user.

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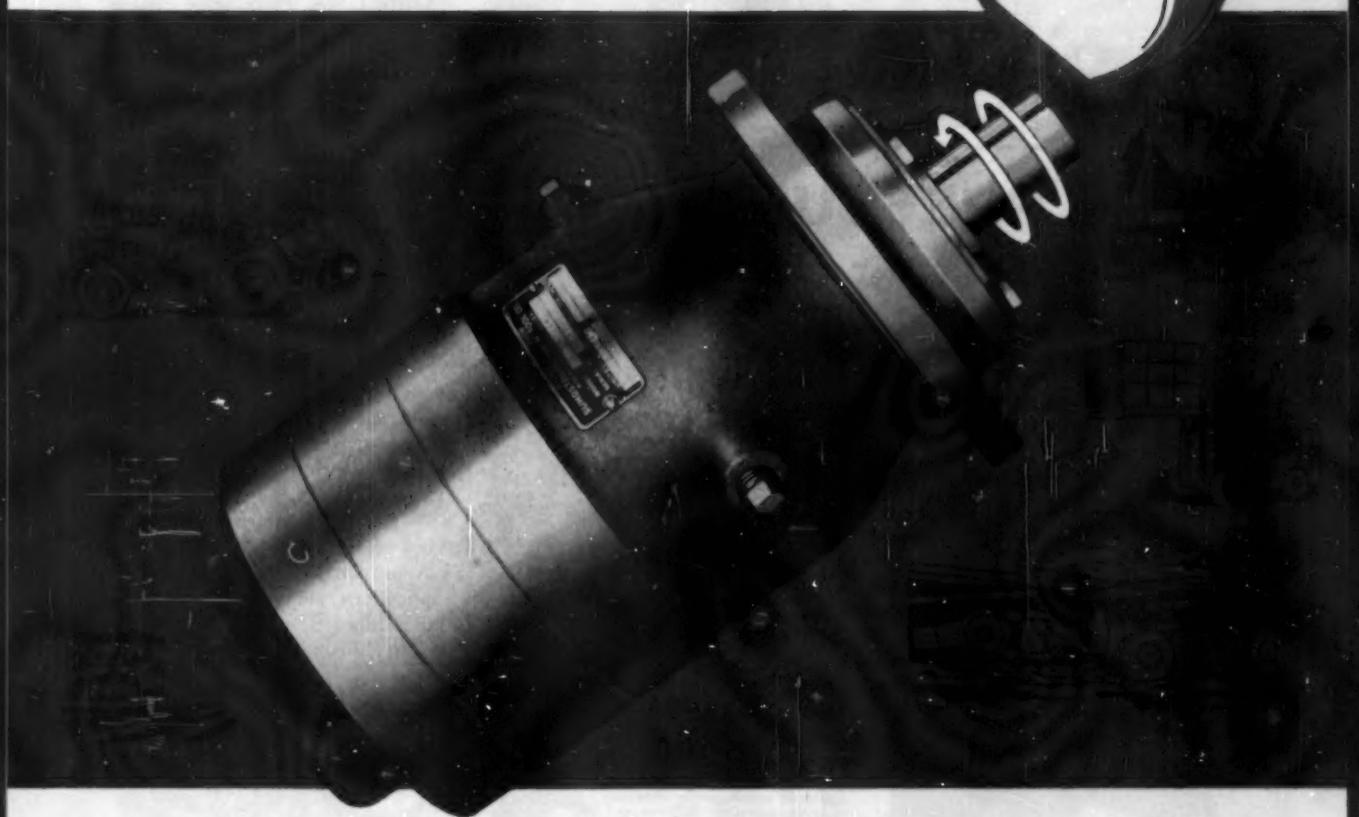

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HIGH TEMPERATURE SEALS

• *Current and Future Sealing Problems Associated with High Temperature*

By N. J. Lumm,
Bendix Products Division,
Bendix Aviation Corporation

This paper is a survey of the Bendix experience with various types of static seals and represents, in effect, an interim report on their test program for materials to be used in high temperature applications. With increased aircraft speeds and altitudes, the possible use of fuel as a cooling medium for hydraulic oil and the known temperature rise through fuel pumps, the problem of higher fuel and ambient air temperatures becomes one of primary concern. Heavier aircraft and higher landing speeds increase the brake loading, increasing the problem of affecting a seal on brake systems. The following are the current and future estimated requirements regarding fuels, temperatures and pressures on fuel metering components and aircraft braking systems.

Fluids include all types, gasoline, air and hydraulic oil (MIL-L-5606). Such components as actuators, valves, etc. will be subjected to the diester type synthetic oils (MIL-L-7808).

Current fuel temperature ranges for fuel metering components have been listed as –65 F to 250 F; air temperatures from –65 F to 325 F. For future requirements we are planning on ranges of –80 F to 350 F and –80 F to 700 F respectively. Brake systems are expected to meet requirements of —80 F to 400 F. Higher fuel temperatures may be limited by an accelerated gum formation problem (close fitting valves, etc.). Acceleration of gum formation may begin as low as 150 F and very probably can be expected above 200 F.

Current and future requirements for fuel pressures range from 0 to 2000 psi, with special cases using synthetic oils to a maximum of 4500 psi. Brake systems must withstand pressures up to 3000 psi.

Approximately 90 percent of seal applications being discussed are static dimetral or face seals. The remainder comprise rotary and reciprocating seals; some aircraft brake systems require reciprocating strokes up to 3 inches. Aircraft brakes also use large OD lip or cup type seals travelling up to ⅜ inch.

A series of cycles at both high and low temperatures in various grades of aromatic fuel is planned to evaluate fuel seal material for functional performance. Aircraft brake systems are evaluated for sealing, pressure, heat and endurance cycling (MIL-W-5013B).

Test Summaries — Rubber

The current design of our fuel metering equipment utilizes synthetic rubber "O" section rings in dimetral and face type applications for both internal and external seals. Brake systems utilize lip or cup synthetic rubber seals in addition to "O" section rings. The synthetic rubber seal has very definite advantages over the currently available metal and plastic seals. Advantages are ease of assembly and

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Model No.	Maximum Input Air Pressure	Nominal Ratio	Discharge Pressure at 100 PSI. Input Air Pressure	Prices, F.O.B. Gardena, Calif.
S-216-C- 10	150 PSI	10:1	1,100 PSI	$220.00
S-216-C- 20	150 PSI	20:1	2,100 PSI	210.00
S-216-C- 35	150 PSI	35:1	4,600 PSI	173.25
S-216-C- 60	150 PSI	60:1	6,600 PSI	173.25
S-216-C-100	150 PSI	100:1	8,800 PSI	173.25
S-216-C-150	150 PSI	150:1	15,200 PSI	194.50
S-216-C-200	150 PSI	200:1	23,750 PSI	225.00
S-216-C-300	100 PSI	300:1	33,500 PSI	289.50

SPRAGUE *Engineering Corporation*

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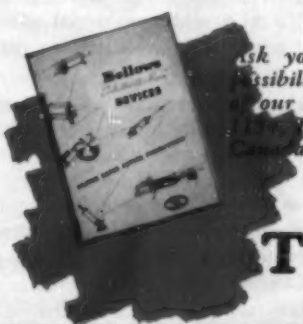
or how to make an air cylinder piston rod behave

Start an ordinary air cylinder and its natural tendency is to proceed at a fairly uniform rate to the full length of its stroke.
But with this "packaged" air cylinder power unit the piston rod can start its advance at a high rate of speed, slow to a snail's pace when you wish, stop completely at any desired point, and resume either a slow or high speed as you prefer.

Not all pneumatic applications require the range of piston rod speed control available in this model DCSTSBEM combination Bellows Air Motor and Hydro-Check, of course. But, regardless of the type of control you require, you can obtain it in Bellows Air Motors . . . and usually in the form of one compact, complete, "packaged" unit — simple to install, doubly simple to control.



sk your Local Bellows Field Engineer to show you the range of control ssibilities in Bellows Air Motors and Hydro-Checks—or write for a copy our new free 36-page bulletin. Ask for Bulletin CL-50. Address Dept. AH-The Bellows Co., Akron, Ohio. In Canada, Bellows Pneumatic Devices of a, Ltd., Toronto. In California, The Bellows Co. of California, Los Angeles.

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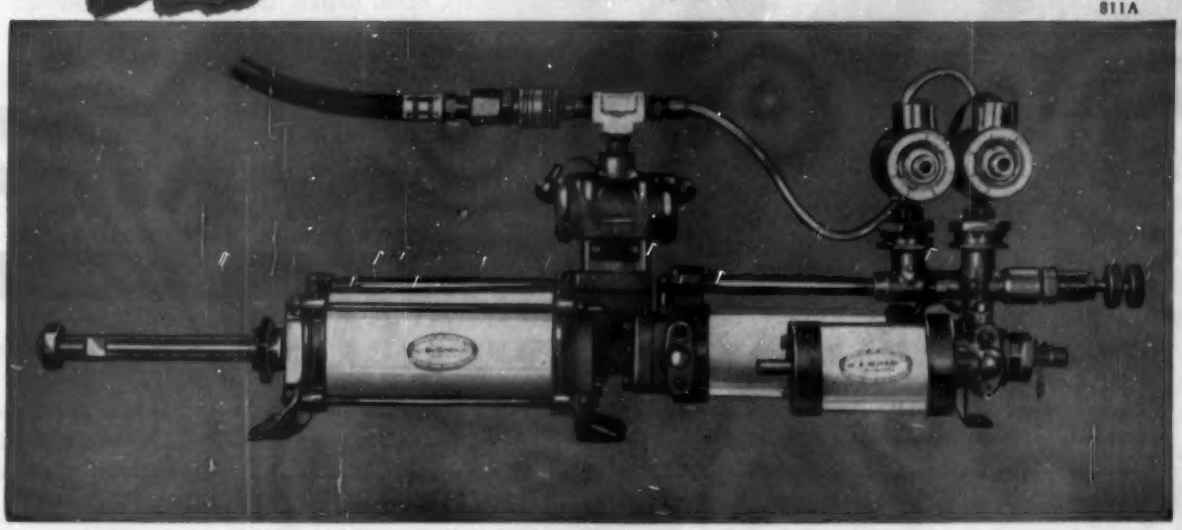

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gives less leakage, less friction, longer life, greater economy

Only Conpor gives you a complete range of porosity control

Conpor *is not* merely leather which has been surface-coated with an impervious elastomer. **Conpor** *is* a long-sought series of new and vastly superior materials for lubricant sealing, in which elastomer and leather are combined permanently to produce the exact degree of porosity and lubricity required. Lubrication of the sealing lip is controlled to give longer life and higher efficiency while objectionable leakage is minimized. **Conpor** *is not* completely impregnated.

Conpor sealing members are compatible with a wide variety of oils, hydraulic fluids, solvents, and gases. They remain flexible, heat stable, and fully operative for longer periods and at higher temperatures than any similar material. No other sealing material offers **Conpor's** outstanding advantages, long service life, and low cost.

Let Chicago Rawhide engineers show you how to solve your sealing problems at lower cost—with **Conpor**.

SEALS

Whether your application requires starved, semi-starved, or flooded sealing, Conpor provides the exactly right degree of lubricant retention.

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Conpor sealing elements give full-depth lubricant storage—from sealing lip through the entire body.

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Lubricant is available to the shaft contact area as required. There is no impervious film to endanger lubrication.

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Oil Seals: Shaft and end face seals for all types of lubricant retention and dirt exclusion • Sirvene (Synthetic rubber) diaphragms, boots, gaskets, and similar parts for critical operating conditions • Sirvis: Mechanical leather packings and related products.

dis-assembly, allowance between metal parts while maintaining a positive seal, a flexible member that does require excessibly high torques, interchangeability in the field and, perhaps most important, the continuance of existing designs for space limitation requirements.

Both low and high temperature types of rubber are available for sealing materials in fuel applications. The low temperature materials have sealed satisfactorily in fuel systems from –65 F to 200 F in JP-4 fuel to 1000 psi. Our evaluation of the high temperature material has so far been limited to use in diester synthetic oils at –65 F to 350 F.

Aircraft brake applications use a 70 durometer oil resistant rubber for lip and cup type seals. While the side next to the hot brake shoes hardens and cracks, the use of a grease lubricant, such as DC-4, helps this condition somewhat.

Test Summaries — Metal

Four different types of metal seals in use are: (1) metal "O" section rings; (2) Spiral wound gasket; (3) Soft metal gasket; and (4) reed or chevron type seal. The biggest disadvantage of most metal seals, of course, is their limitation to use as face type seals only, practically ruling them out for most internal sealing applications.

Two different types of metal "O" section rings have been partially evaluated. One that sealed satisfactorily at 200 F was marginal at fuel temperatures up to 350 F; the other was marginal at both –65 F and room temperature.

A metal spiral wound gasket filled with asbestos has been partially evaluated. So far satisfactory sealing has been obtained from –65 F to 350 F up to 2000 psi fuel pressure. Surface finishes from 40 to 200 RMS have proved satisfactory. This type seems to be superior to other metal types of seals evaluated to date.

Metal gaskets of soft and half-hard aluminum and annealed copper have had very little evaluation. Very high clamping loads are necessary to get satisfactory sealing; the use of concentric grooves at the mating surface were found to be definitely advantageous. Temperature and pressure range limitations are as yet unknown.

Very little has been done with the reed or chevron type seal. Known to require surface finishes of 6 RMS or less on mating surfaces, the seal is rather expensive. Disadvantages are the numerous piece-parts required, assembly and dis-assembly in production and in the field and the danger of seal lip damage from improper handling and assembly. This seal may prove more useful on rotating shaft applications, since it is the only metal type known that can be so used.

Plastic Materials

Three types of plastic materials —various forms of KEL-F, Teflon and Silicone—fall in this classification. Both KEL-F and Teflon in "O" ring form show far too much cold flow and permanent set to consider. Also, leakage was experienced at –65 F and at room temperature

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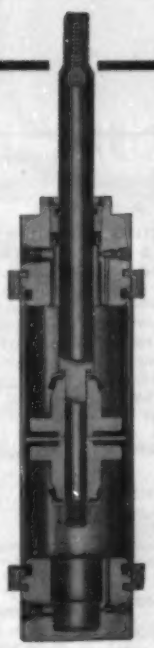

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Oil return lines	Scooter & wagon parts
Dip stick tubes	Spacers
Oiler tubes	Pop guns
Automatic transmission	Bicycle parts
FARM EQUIPMENT	Mechanical toys
Hydraulic lifting devices	Tables
Support tubes	Chairs
Lubrication lines	Swings
Fuel lines	Baby carriages, cribs, car seats and beds
Fuel manifolds	MISCELLANEOUS
ELECTRICAL	Umbrellas
Ceiling & wall fixtures	Display boards
Lamp tubes	Panels
Heating elements	Conveyor oil lines
Radio & TV antennae	Lawn mower handles
	Hose reels

AVON TUBE DIVISION

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after cold soak. Some work was also done with a silicone core coated with KEL-F. The lack of elasticity limited this type to face seal applications and a high temperature limit of approximately 275 F.

Silicone (Dow Corning 7-181) rings gave adequate sealing from –65 F to 400 F in dry air for internal applications. For external applications the high temperature limit probably will not exceed 300 F. Use in fuel was out of the question due to rapid deterioration; use in hydrocarbon oil is limited to 200 F for the same reason. Use in diester oils was not found to be practical at any temperature. Because of extremely high shrinkage after molding, special molds have been found necessary to obtain correctly dimensional parts.

Limited evaluation on teflon spiral back-up rings indicates that it may be possible to use current low temperature synthetic rubber materials for temperatures higher than 200 F. Used as a sole seal, these rings provide fairly adequate sealing for internal applications at room temperatures and at pressures to 1000 psi.

J. W. Sackett, Thompson Products, Inc., in his paper "*Analysis of Non-Metallic Materials and Their Application to Aircraft Seals*" covered the characteristics and possible uses of Buna N synthetic rubber, the polyacrylic ester polymer, silicone rubber and teflon in high temperature from the standpoint of OEM user. He summarized by stating that, with complete cooperation between the basic designer, material engineer, and seal designer, he believes that the majority of so-called temperature problems existing with non-metallic materials can be eliminated with the materials available at present.

Kenneth Parker, United Aircraft Products, Inc., in "*The Self-Energizing Metallic "O" Ring for Aircraft Static Seals*" presented a detailed design and application picture of this type of seal, developed to meet

Circle 14 on Reader Service Card

the need of the aircraft industry for a static seal which is relatively unaffected by temperature. The unique self-energizing feature of this seal is accomplished by the venting action of holes drilled on the inside diameter of the "O" ring, allowing the pressure being sealed to get inside the tube. This ring has been used successfully in aircraft systems containing hydraulic oil, lubricating oil, jet engine fuel, gasoline, rocket fuels, liquid metals, combustion gases and in pneumatic systems. Applications include temperature ranges from –70 F to 1800 F and pressures up to 10,000 psi.

"*Silicone Rubber: Its Resistance to Fluid Media in Aircraft Applications*" by B. B. White and D. P. Spalding, Silicone Products Department, General Electric Company is a survey of the progress made and being made in five primary classes of silicone rubber and a presentation of detailed application data on the resistance of these rubbers to the three main types of fluids (fuels, lubricants and air) in aircraft applications. Emphasis is given to Class 300—the low compression set stocks, which in addition to the lowest compression set properties of all known elastomers, is the most resistant to the majority of fluids—both fuel and oil types—commonly encountered in aviation applications. The presentation included tables covering effects of eleven fluid fuels and ten lubricants and hydraulic fluids on silicone stocks (following ASTM Method D471-52T), recommendations for the design of silicone rubber static seals and a number of successful silicone rubber seal applications on aircraft.

Ralph L. Skinner, Jr., Flexible Seal Company, in his paper "*Wedge-Type Teflon and Spring Metallic Seals*" outlines the characteristics and applications of these newly developed seals. The wedge type teflon seal was developed to be used in the hydraulic shock absorber on the T-41 and similar tanks, where the fluid temperatures get as high as 520 F. The spring-type metallic seal was developed primarily as a nozzle seal on jet aircraft engines. This seal can be used wherever a high temperature face type seal is required.

The wedge type teflon seal can be used for continuous temperatures as high as 500 F and for short, intermittent temperatures as high as 570 F. Fillers of calcium fluoride and glass have been used to give greater resistance to pressure. Two companies have tested this seal on the hydraulic shock absorber application for as high as 175 hours with average temperatures of 480 F and maximum temperatures of 520 F. The wedge seal has sealed successfully as a static seal at pressures as high as 700 psi.

The spring-type metallic seal have been fabricated from type 410 stainless steel, aluminum bronze and Inconel X, depending upon temperature requirements. For applications no higher than 300 F aluminum bronze gives very fine spring properties; type 410 stainless can be used at temperatures as high as 600 F. For higher temperatures—1000 or even 1500 F—Inconel X, age-hardened, is used. Seals can be compressed as much as .015 inch without permanent deformation and are re-useable. These seals have passed tests of gasoline at pressures as high as 5000 psi. They do require surface finishes to 6 to 10 RMS to give perfect sealing and a hard mating surface to prevent the seal gouging in.

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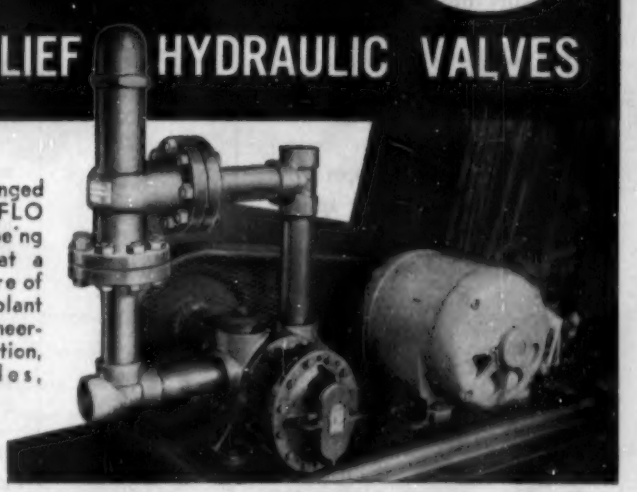

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You, too, can profit by using America's simplest, quietest and most efficient valves—flanged or standard types. Select from 5 springs for pressure desired, install—and that's all . . . no maintenance required.

NON-CHATTERING.

PIPE sizes ¼" to 2". Brass or cast iron.

For ram presses, machine tool hydraulic mechanism, Diesel and oil-burning equipment.

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BASIC SWITCH
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● You get long life *plus* tolerance stability which gives positive snap-action and accurate repeatability throughout the entire life of the switch . . . even at 1,500,000 cycles and over.

Silver Contacts minimize arcing, assuring precision control and long electrical operation. Patented, self-aligning springs provide contact wiping action seldom found in a switch of this size.

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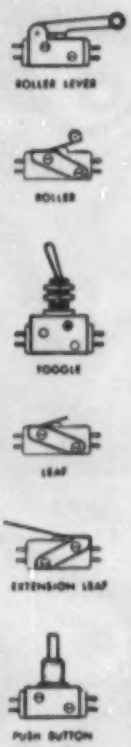
Long life lowers switch costs . . . minimizes "down-time" and increases efficiency of operation. Durable, compact plastic case permits great flexibility of application. Available in a wide selection of models, including "reset." Rated at 10 amps 125/250 v. AC; 30 v. DC inductive.

Write for details in Data Sheet STF-11.

A few of the standard actuators available.



ELECTRO-SNAP SWITCH AND MFG. CO.

Master and Slave Circuits

Concluded from page 61

angular piston movement is converted to translatory motion of the control valve by the control column mechanism.

The system implies that two definite steps occur, but the sequence is rapid and simultaneous so that the steps are not obvious unless run at low speeds.

The turret is rotated by means of a fluid motor through a gear train. Once again, the motions of the pistol grip merely operate a valve which controls the fluid motor. Unlike the 4-way valves in the indexing and elevation circuits, the rotation follow-up valve operates by rotation, rather than translation and the follow-up system is incorporated in the valve. The follow-up system is such that the valve is opened by rotating one pulley in one direction (holding the second pulley stationary) and is closed by rotating the second pulley an equal amount in the opposite direction (holding the first pulley stationary). However, as in the indexing and elevation circuits, these two steps occur simultaneously, so that they are not obvious, unless run at a very slow speed.

The principles of this servo design are applicable to many machines where a similar degree of accuracy is desired.

Portable Test Stand

Concluded from page 63

hydraulic pressure gauge is read. At this tachometer setting the work being done is approximately equivalent to the operation of a pneumatic drill, with a ¼ inch drill, drilling into solid aluminum.

When the hydraulic pressure gauge, 12, readings are taken, the flow meter readings are read. The flow meter indicates the number of cubic feet of air per minute going through the tool. This check is necessary because it is possible to get a correct pressure guage reading even though the tool may be badly worn. But, wear will show up in the flow meter test, indicating that the tool is using too much air to attain the desired pressure reading. Incidentally, rpm tests don't seem to be helpful in the whole program except to establish a basic operating condition for the tool.

The maximum and minimum readings, acceptable to Ryan, have been determined in a program in which Ryan checked 100 motors of each type and brand of pneumatic tool. These readings were then charted on a graph and they gave definite curves. Then, Ryan engineers selected minimum and maximum figures; and, fortunately, these standards have turned out well and have been maintained. The cart pressure test is actually a comparative type of test in which the figures obtained are compared with the tabluations developed. All of the requirements have been standardized to match the test conditions. The pressure regulator is set at 70 psi in order that pressure can be uniformly maintained, even though this is below actual airline pressure used at the tools.

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Realistic Planning

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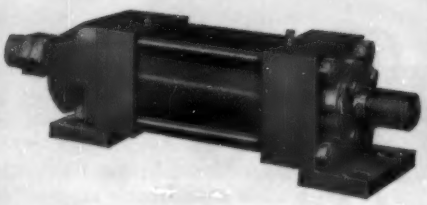

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For over three-quarters of a century H-P-M engineers have designed equipment — and motions — for varied requirements. Now, with a complete line of air and hydraulic components as part of our standard line you are assured of complete responsibility for your automatic systems. The hydraulic cylinders, valves, pumps and power units illustrated are typical of the air and oil hydraulic equipment in the H-P-M line. Call in the H-P-M Field Engineer in your locality when power, or the control of power, is your problem. The experience of the H-P-M organization will be of real assistance.

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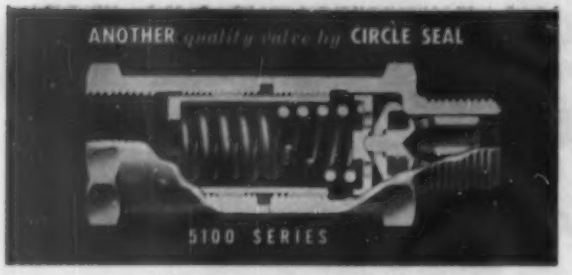

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- Precise operating reliability
- Suitable for almost any gas or liquid

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Ultra-sensitive for very low pressure gas systems.... ☐

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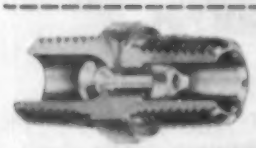
For almost any service, gas or liquid. 0-3000 psi..... ☐



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For gas or liquid service, 0-10,000 psi ..... ☐

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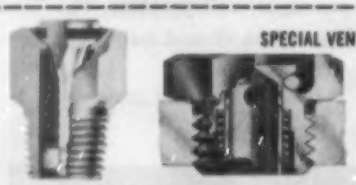

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For low pressure gas service.. ☐

CIRCLE SEAL *precision valves*

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Care of Hydraulic Oil

Concluded from page 67

serted into the reservoir and the filter is allowed to circulate the oil until it becomes clean.

A higher flow rate is required for a portable unit than is required for a continuous operating type. The portable unit should be three to ten times larger than a filter that operates continuously on one machine. Intermittent filtering, represented by the portable unit, amounts to a reclaiming process and a much larger filter is required to reclaim or batch-filter an oil than to keep it clean by continuous operation. An advantage of the portable, intermittent type filtration is that the unit can be operated, unattended, through the night or other period when the hydsaulic mechanism is down.

It may be desirable at times to remove the oil from machines and batch-treat it. Under operating conditions which allow considerable amounts of water or soluble oil to leak into the hydraulic oil, it becomes necessary to remove the oil from the reservoir to separate it from the water. The oil-and-water mixture is then placed in heated settling tanks. Quite often the water will emulsify with the oil into a water-in-oil emulsion which will not settle out unless heat is applied. Often, the rust inhibitor will act as an emulsifying agent and aggravate the situation. Oil deterioration products also render the separation of the water more difficult, making the use of emulsion breakers necessary in some cases.

The temperature of the oil in the settling tank is raised, normally to 180 F and held for 24 hours. A higher temperature or a longer settling period may be necessary if the water does not settle readily. The elevated temperature tends to break the emulsion, reduce the viscosity of the oil and make a greater difference in the specific gravities of the water and the oil. After the water is settled out, the oil is then circulated through a filter until it is thoroughly cleaned.

A large electrical manufacturer who was particularly bothered with water getting into his hydraulic systems solved this difficulty by treating his oil in cone bottomed, heated settling tanks. A settling period of several hours removed the water and a considerable amount of the dirt. Then the oil was purified through a large fuller's earth type filter. Approximately 2500 gallons of oil were purified through each 300 pound refill.

It is desirable at times to connect a number of hydraulically actuated machines into a central system. One method for central system operation is to connect all the reservoirs into a common oil header line. An overflow line is also connected into each reservoir; this overflow line connects into a common line which drains by gravity into a central accumulator tank. A large filter, equipped with its own pump and motor circulates on the oil in the tank independent of the rest of the system. A low head centrifugal pump picks up oil from this tank and discharges it into the oil header. Individual proportioning valves regulate the flow to each machine reservoir. Excess oil overflows through the overflow line and is returned to the accumulator tank.

Could you do this with any other leather packing?

WHEN SQUEEZED . . . . . EVEN TIGHTLY CLOSED . . . . . IT SPRINGS OPEN!

It's Resilient!

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LEATHER CUP PACKING

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Sealing the tiny interstices in leather . . . thoroughly . . . makes the big difference. We've done it with a special type of synthetic rubber.

You benefit by that difference . . . in packings that last longer and produce tighter seals. They just don't seem to wear out, users tell us.

This Houghton development combines the best features of both leather and rubber packings. It gives you leather's strength, low friction, and long life, plus the non-porosity and resilience only rubber provides. And add to this a new design feature that has revolutionized packing tradition.

That's VIM 1243-3, the biggest advance in cup packings in the past twenty years. Ask the Houghton Man, or write E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.

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listing standard sizes accepted by industry. It will be mailed without cost to you.

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Ready to give you on-the-job service . . .

Easier to apply . . .

Compact, versatile; choice of 3 mountings and 7 manual, solenoid, cam or pilot operating means for pneumatic, hydraulic systems to 200 p.s.i.

Easier to install . . .

Sub-base, console and panel, or conventional piped mountings available. Made in ⅜", ½", ¾" and 1" NPT port sizes.

Easier to service . . .

Only moving part is one-piece spool carrying all moving seals which are standard "O" rings stocked by industrial supply houses; replaceable in minutes—no springs or retainers.

4-way double solenoid MV is only 9¾" x 3½" x 2⅝" overall (½" NPT ports); handles to 150 p.s.i.

Lever-operated MV valve body with ½" NPT ports is only 4" x 3½" x 2⅝". Handles to 200 p.s.i.

Don't lose time and money with misfits or specials when a stock MODERNAIR MV valve will do your job. Modernair valves, cylinders and parts are stocked in principal U.S. and Canadian cities, and at factory. For prompt delivery, call your authorized dealer or write us now for specifications and prices.

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106 Circle 87 on Reader Service Card

NEW PRODUCTS

Components, tools and equipment designed to improve operation of fluid power systems are described here . . . for more information fill in and mail the post card bound in this issue.

Continued from page 42

ELECTRONIC TIMER

. . . for valve actuation

Designation: Model T2

Features: The circuit design of this timer maintains 1 per cent accuracy over line voltage variations of 90-135

volts. It has three time ranges of 0.1-1 sec., 1-10 sec., 10-100 sec.; direct reading time dial; two SPDT load contacts with 8-ampere rating.

Applications: For sequence control of automated machinery, machine tools, injection molding machines and packaging machinery.

Ferrara, Inc.
Oak Park, Michigan
Circle 209 on Reader Service Card

"O" RINGS

. . . are precision molded

Size: Standard sizes from ¼" to 16" od

Design: A new series of industrial

"O" rings, for general hydraulics fluid, water and air service, are precision molded of Buna N fuel and oil resistant compounds.

Application: Can be used in automotive, aircraft, agricultural, petroleum and railroad industries. Have varied applications on machinery used in machine tool making, mining, paper making, printing, woodworking and plastics.

Stillman Rubber Co.,
Culver City, Cal.
Circle 210 on Reader Service Card

DOUBLE RELIEF VALVE

. . . cuts required pressure connections

Designation: Series AA-31350

Design: Consists of a conventional aircraft relief valve and four poppet-type check valves combined in a single housing. The new double-acting units require only four pressure connections for installation.

Features: Because of the combined housing, the valve occupies less space and provides savings in weight. The valves are adjustable for relief conditions within the pressure range (cracking pressure) of 900 to 4100 psi.

Applications: This valve will simplify circuits which require braking action for overload protection in both directions of fluid motor or cylinder travel.

Vickers Incorporated
Detroit, Michigan
Circle 211 on Reader Service Card

DIAL THERMOMETER
. . . has Bourdon coil drive

Designation: No. 35-S

Features: Mercury actuated, this thermometer has stainless steel case with clear plastic face covering and gasket sealed to stainless steel back

plate. Dial face is 3½ inches, has large numerals and degree marks for easy reading at long range. The dial case can be rotated to any readable position.

Sizes: Stem is ½ inch in diameter, has a stainless steel bulb of standard lengths, 4, 6, 8 and 12 inches.

Palmer Thermometers, Inc.
Cincinnati, Ohio

Circle 212 on Reader Service Card

HYDRAULIC TEST STAND
. . . offers versatility at low cost

Designation: Model JK-100

Construction: Test machine has a sturdy steel cabinet, automatic temperature control of oil by means of a thermostatically actuated water

cooling circuit. Power to drive the pump is supplied by a 15 hp, 1800 rpm, 220/440 volt, 60 cycle, 3 phase motor. Motor is operated through a size 2, NEMA 1 enclosed overload

High Pressure
HYDRAULIC
CYLINDERS
Patent Pending
Cut downtime
with "quick-change"
rod packing cartridge
• 2,000 P.S.I.
• J. I. C. STANDARDS
• COMPACT DESIGN
• OPTIONAL ROD SIZES
• ALL-STEEL CONSTRUCTION
• 11 TYPES OF MOUNTINGS
• 11 BORE SIZES—1½" TO 8"
• UP-TO-DATE ENGINEERING
The S-P "quick-change" packing cartridge is easily removed for servicing seal or wiper. Cuts downtime . . . speeds production. S-P Hydraulic Cylinders have every modern design feature. Representatives in principal cities. Prompt deliveries. Send for Catalog 104. The S-P Manufacturing Corp., 12415 Euclid Ave., Cleveland 6, Ohio.
THE S-P MFG. CORP. — Cleveland
A Bassett Company
PRECISION PRODUCTS SINCE 1918
AIR AND HYDRAULIC CYLINDERS • POWER CHUCKS • ROTATING AIR CYLINDERS
COLLET AND DRILL PRESS CHUCKS • AIR PISTONS, VALVES AND ACCESSORIES

Circle 109 on Reader Service Card

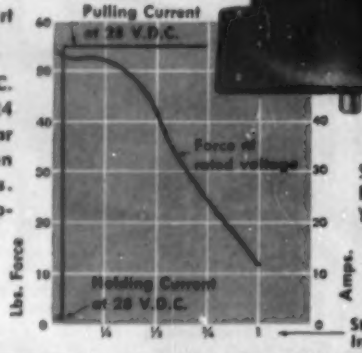
Circle 33 on Reader Service Card

Decco DUAL WOUND
D. C. SOLENOIDS

Because of its "Dual wound" construction the new Decco Series 29 D. C. Solenoid is able to deliver tremendous force in small space in continuous service. See Force Stroke Chart below.

Compact
Efficient
Powerful

This compact, new D.C. Solenoid is available in 24 to 250 Volt range, regular or waterproof construction —J.I.C. Specifications. Ideal for mobile equipment.



SPECIAL SOLENOIDS ENGINEERED TO YOUR NEEDS

Decco

DETROIT COIL COMPANY
2435 HILTON ROAD, FERNDALE 20, MICHIGAN

SEND your specifications for hydraulic cylinders to American, specialists in hollow boring and honing. We manufacture from tubing or forgings in carbon or alloy steels up to 15" I.D. Over 40 years experience backed by precision machines and skilled craftsmen will save you time and money. Send your blueprints.

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AMERICAN HOLLOW BORING COMPANY
1954 RASPBERRY STREET • ERIE, PA.

SPECIALISTS IN THE MANUFACTURE OF HYDRAULIC CYLINDERS

New Products

Continued

cutout magnetic starter which is remotely controlled from a panel-mounted start-stop pushbutton switch. Operates at pressures up to 3000 psi, flows to 6 gpm.

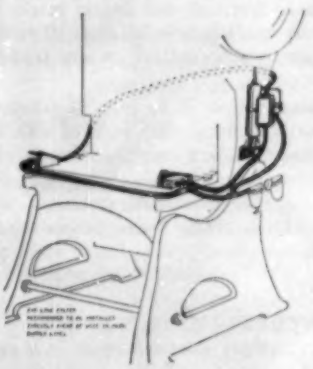
Applications: For testing performance and operating characteristics of aircraft or industrial accessories.

Greer Hydraulics, Inc.
Jamaica, New York
Circle 213 on Reader Service Card

PNEUMATIC CONTROL
. . . for press operation

Designation: PMC

Features: Unit operates from the shop air line. It reduces operator fatigue and improves protection on



hazardous machinery. The pneumatic circuit requires that both operating valves be depressed before action takes place. Only one non-repeat action occurs when both valves are depressed.

Applications: For the control of power presses, brakes, shears and machines utilizing mechanical clutches.

Sizes: Available in either 2 or 3 inch cylinder bores, and any desired stroke length.

Modernair Corporation
San Leandro, Calif.
Circle 214 on Reader Service Card

RELIEF VALVE
. . . gives fast response

Design: In this differential piston-type relief valve, pressure acts on the annular area between the O.D. and a reduced diameter of the piston. Effective force of pressure is not reduced by the high velocity-low pressure conditions which occur ahead of the seat. As a result, relief pres-

CUT COSTS

with the Original Mead

MIDGET AIR CLAMP

(Spring Return Air Cylinder)

In assembly jigs and other multiple applications, this new, low cost pressure unit saves countless man-hours. As a work-ejector in many fixtures, it is unexcelled.

Advantages over mechanical clamps

1 **All Air Clamps** in any set-up can be operated by a single master valve—the "lock-up" and release of assemblies is instantaneous.

2 **May be installed in cramped corners** difficult to reach with bulky mechanical clamps. Mead Midget is the most compact air cylinder, for its power, on the market.

3 **Equal ram pressure at any point** along stroke, making special, delicate adjustments unnecessary.

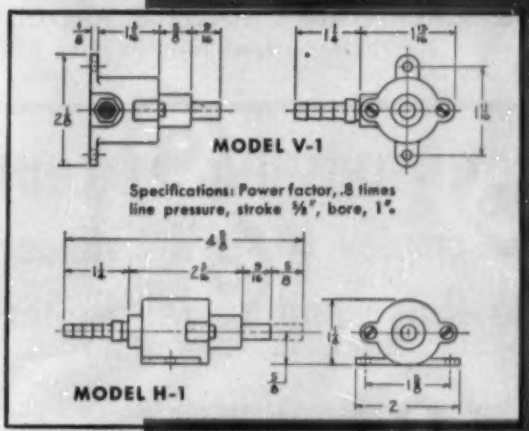
4 **Independent group control.** Any desired group of "Midgets" can be controlled independently of any other group in an assembly—as where primary members of the fixture must be locked up before the secondary members.

5 **Facilitates delicate drill operations.** Air Clamps actuated by foot control valves leave operator's hands free to handle the work pieces.

Send for all the interesting facts on these time-tested, superior Midget Air Clamps.

MEAD SPECIALTIES COMPANY

4114 North Knox Avenue • Dept. AH-114 • Chicago 41, Illinois



IMMEDIATE DELIVERY

Single-acting cylinders delivered from stock; double-acting in a few days.

Send Out MEMO Coupon Now For

New MEAD INDUSTRIAL AIR POWER CATALOG

Memo Coupon

MEAD SPECIALTIES CO.
4114 N. Knox Ave., DEPT. AH-114, Chicago 41, Ill.

Send free copy of new, colored MEAD INDUSTRIAL AIR POWER CATALOG describing the complete line of famous Mead air-operated devices.

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Company_____

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Circle 8 on Reader Service Card

"Your company is still our best source on pump thrust plates"

—says one of America's largest road machinery builders. But that's what they all say.

You, too, should get acquainted with

PROMET Iron & Engineered BRONZE

BEARINGS • BUSHINGS • WEARING PARTS

They're sold with a money-back guarantee of longer service.

Castings to your patterns—any size, shape or section—delivered as scheduled and specified. Pattern making, designing and machining when required.

Write for free literature and service data sheets. Send blueprints, conditions of operation and other data for recommendations and quotations. You are invited to discuss your bearing problems with our metallurgists, engineers, and laboratory technicians.

THE AMERICAN CRUCIBLE PRODUCTS CO.

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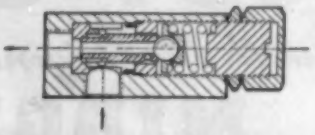
1303 Oberlin Avenue • Lorain, Ohio, U.S.A.

sure is more nearly constant. The valve is quiet, has fast response to pressure surges.

Applications: For circuits where pilot-operated relief valves are too



slow and for critical applications in which failure to hold pressure would be dangerous.

Sizes: Available in ¼ and ⅜ inch.

Fluid Controls, Inc.
Mentor, Ohio

Circle 215 on Reader Service Card

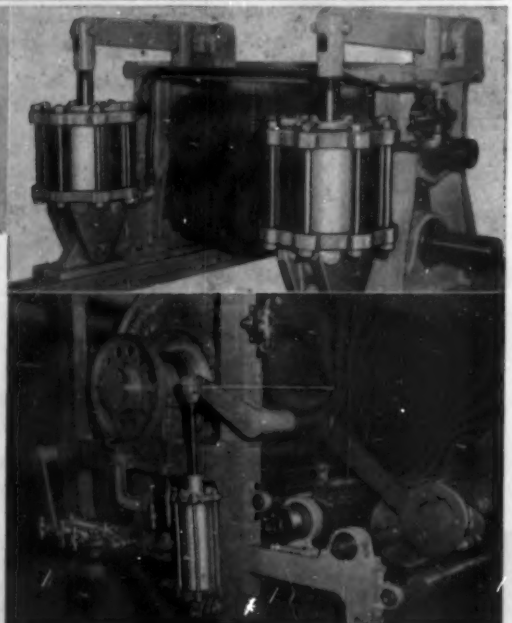
TWO WAY SOLENOID VALVES . . . with diaphragm member

Designation: Bulletin 8210A, Normally Open or Normally Closed.

Design: Three operating parts: all stainless steel core; stainless steel spring and hycar diaphragm. Forged brass bonnet and body insures freedom from porosity.

Features: Mountable in any position. All internal parts on the pilot are readily accessible without remov-

CLOTH-FINISHING MACHINES . . . employ NOPAK Cylinders to Raise and Lower Rollers



The David Gessner Company, Worcester, Mass., manufacturers of modern cloth finishing equipment, employs NOPAK Air Cylinders in its sizing machines to raise and lower heavy rollers, and, in some cases, to equalize roller pressures. The examples pictured may suggest how you, too, can use NOPAK Cylinders, controlled by NOPAK Operating Valves, to build accurate, simplified machine movements into your plant equipment, or into machinery that you manufacture for resale.

The NOPAK Application Manual shows you how NOPAK Valves and Cylinders are being used in all types of industry, in many types of machinery and equipment for pulling, pushing, lifting, lowering, clamping, positioning. If you haven't seen a copy, ask your NOPAK representative, or write.

GALLAND-HENNING NOPAK DIVISION

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Write for Bulletin SW-2

Representatives in Principal Cities

NOPAK VALVES AND CYLINDERS

DESIGNED for AIR and HYDRAULIC SERVICE

A 7996-½-HA

ing the valve body from the pipe line.

Operation: Normally closed (closed when de-energized, open when energized). Solenoid de-energized: pilot port is closed, full line pressure is applied to disc, provides seating force for tight closure. Solenoid energized:

pilot port is opened, releasing pressure on top of diaphragm to outlet side of valve. Line pressure raises diaphragm to open main port and permit full flow. Normally open (open when de-energized, closed when energized). Operates on same principle as the normally closed. However the pilot port is located in the top of the solenoid and the pilot port in the diaphragm is sealed.

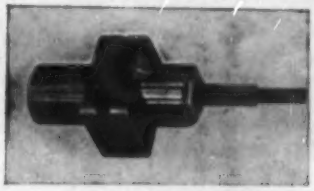
Applications: For a variety of installations, providing automatic control of flow of liquids in a pipe line.

Specifications: Pipe sizes ⅜, ½, ¾ and 1 inch. Maximum pressure 250 psi on air (normally open), 200 psi on air (normally closed). Can be used on all standard A-C and D-C voltages.

Automatic Switch Company
Orange, N. J.
Circle 216 on Reader Service Card

CLAMPING FIXTURE CYLINDER
. . . has non-rotating piston rod

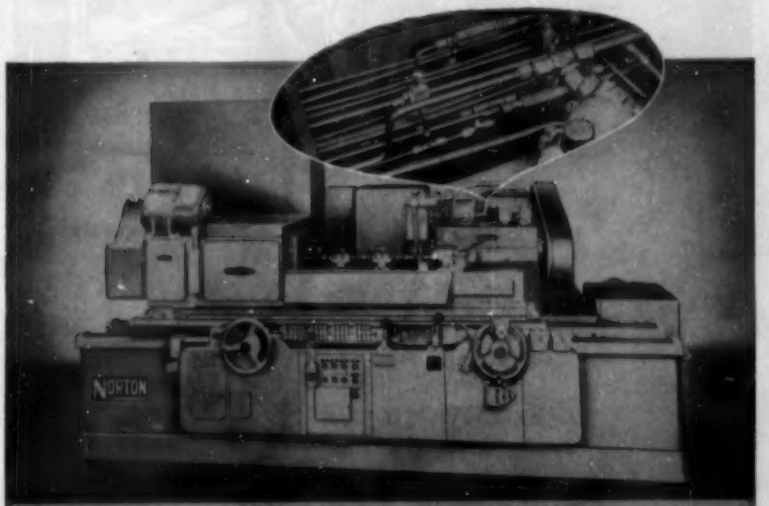
Designation: No-Ro-Fix Square Rod Clamping Fixture Cylinder



Design: Compact and of heavy-duty construction, cylinder has few component parts. The piston rod is supported by a long oversize bronze bearing. Seal is by standard O-ring. Piston and rod are of chrome plated steel with the cylinder barrel and the blind end of nickel-plated brass. The rod end is nickel-plated bronze. A mounting block permits adjustment of the cylinder to its full length in the mounting block by loosening one screw.

Sizes: Supplied with a 1 inch bore, having a ⅛ inch pipe thread air connection, in 1, 2, 3, and 4 inch strokes, with spring return. Larger bore square rod cylinders available on request.

The Beckett-Harcum Co.
Wilmington, Ohio
Circle 217 on Reader Service Card



CAMSHAFT GRINDING—HIGH PRESSURE JOB
TAILOR MADE FOR SUPERIOR HYDRAULIC TUBING

One reason why Detroit can turn out cars in such huge numbers is their use of new machine tools which, until a few years ago, were just a gleam in a designer's eye. Good example is the Cam-O-Matic* . . . a high speed, fully automatic camshaft grinder developed by the Norton Company of Worcester, Mass.

The Cam-O-Matic has a highly complex hydraulic system for holding and positioning work, controlled by an electronic brain which times the sequences of operation. To make this tubing network as failure-free as possible, Norton engineers selected Superior carbon steel hydraulic tubing as a standard component. They knew from experience that Superior *higher-than-industry-quality* tubing can take (1) the punishment of vibration; (2) the high pressures put out by modern hydraulic circulating systems; (3) the severe flaring and bending necessary in assembly. As a result, machine down-time due to tubing failure has been eliminated.

If you use hydraulic tubing and your specifications demand exact analysis, unusual fabricating ease and dimensions that are precise—specify Superior. Mail this coupon today for Bulletin 38, Catalog Section 30 and the name of your nearest distributor.

*Trade Mark Reg. U.S. Pat. Off.

Superior
THE BIG NAME IN SMALL TUBING
All analyses .010" to ⅝" O.D.
Certain analyses (.035" max. wall) up to 1¼" O.D.

Superior Tube Company
2030 Germantown Ave., Norristown, Pa.

Please send Bulletin 38, Catalog Section 30 on Superior hydraulic tubing, and the name of my nearest Superior distributor.

Name_____
Company_____
Address_____
City_____ Zone____ State____

"Do it Yourself" with STRATOFLEX

1. Cut hose to length.

2. Screw on socket.

3. Oil inside and insert assembly tool.

4. Screw swivel nipple or male fitting into socket and remove tool.

Re-Usable Hose Fittings

All-Purpose Flexible Hose

Making up STRATOFLEX Hose Assemblies in your own shop or in the field often saves valuable time. The cost of replacing hose lines can be drastically reduced by installing new STRATOFLEX Hose and re-using the detachable fittings. It pays to keep on hand a supply of STRATOFLEX Hose and Fittings. Order from your dealer or write for FREE catalog today!

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STRATOFLEX, INC./FORT WORTH, TEXAS/P. O. BOX 10398

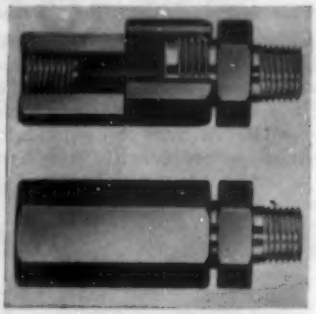
BRANCH PLANTS: Los Angeles and Toronto

SALES OFFICES: Atlanta, Chicago, Dayton, Houston, Kansas City, New York, Portland, Tulsa.

CHECK VALVE
. . . has unique sleeve seal

Designation: Warren Check Valve

Design: Valve consists of sturdy,



two-piece metal body and a special composition sleeve. It has no seat, no spring or other metal moving parts to wear or get out of alignment. The durable sleeve is easily and quickly replaceable if damaged.

Features: Silent in operation, immune to vibration, this valve can be mounted in any position. Trouble-free service is provided even when small amounts of foreign matter are present.

Sizes: Available in a wide range of sizes and materials.

Betts Machine Co.
Warren, Pa.

Circle 218 on Reader Service Card

INTERNAL GROOVE DIAMETER GAGE
. . . for parts with close groove tolerances

Application: Developed as a production gage for use either at the ma-

chine or in final inspection. The gage will repeat to "tenths" under the most adverse conditions. It may be supplied for standard O-ring and snap ring grooves with bores from .480 to 4.750 diameter.

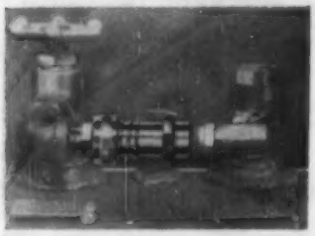
A. G. Davis Gage & Eng. Co.
Hazel Park, Mich.

Circle 219 on Reader Service Card

QUICK DISCONNECT COUPLING
. . . for 1000 psi pressures

Designation: Inst-O-Matic

Design: It has a valve in the socket and a nipple to form a positive seal



at both ends of line. It is made in an aluminum or brass socket and a steel or brass nipple.

Features: Positive dog locking action between socket and nipple, it allows faster changing of tanks. Line can be connected or disconnected in seconds.

Applications: For use on material handling, construction and railroad equipment.

Sizes: Available in ¼ and ⅜ inch.

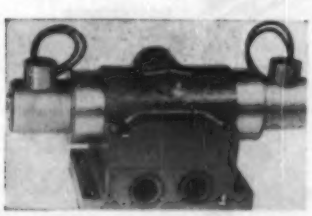
E. B. Wiggins Oil Tool Co.
Los Angeles, California

Circle 220 on Reader Service Card

4-WAY CONTROL VALVES
. . . for 200 psi service

Designation: MV Series

Construction: Lightweight body is cast aluminum, liner is hard-drawn brass, with an aluminum spool.



Features: Simplicity of design, versatility of application, and ease of installation and service. Only moving valve part is the one piece spool, which carries the only moving seals employed. These are standard "O" rings and can be replaced in a few minutes. A full line of standard attachments provide for operation by lever, palm button, foot pedal or treadle roller, cam, solenoid, pilot or remote bleeder button. Parts are standardized and interchangeable so that virtually any type valve may be assembled or repaired from a minimum stock of basic parts. One body casting accommodates ⅛" or ½" NPT ports, the second, ¾" and 1" NPT ports.

Application: Readily adapted to sub-base, manifold, panel, console or conventional piped installation, for air and oil service.

Modernair Corporation,
San Leandro, Cal.

Circle 221 on Reader Service Card

No STILLMAN O-Rings Here!

O-Rings on the floor mean dollars down the drain

O-Ring costs increase with each sweep of the janitor's broom when imperfect rings are thrown on the floor. That's why Stillman's new series of precision, top-quality O-Rings for industrial and commercial use are receiving such a warm welcome. They seal better, last longer, and never find a home in the trash can. If your shop is discarding too many faulty O-Rings, Stillman's new series may be the answer. Investigate today.

Write today for free illustrated industrial O-Ring folder.

Stillman Rubber Co.

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COMPACT DEPENDABLE EFFICIENT

Piston Style, Double Acting
BHEW Hydraulic Cylinder

OPTIONAL MOUNTINGS

It's easy and practical to use BHEW hydraulic cylinders in your applications. Accurately honed barrels, hard chrome-plated rods, small O. D. and any type mounting desired are BHEW cylinder features. All types and sizes available in standard and special O. E. M. designs. BHEW makes single and double acting, high and low pressure cylinders with cup-type, ring-type or O-ring construction. Send specifications of your requirements.

BHEW

Pressure Operated Hydraulic Flow Control Valves, for lift trucks, eliminate surge as load starts down. Load weight controls rate of descent, full speed raising and empty fork travel. Write for details.

BENTON HARBOR ENGINEERING WORKS, Inc.

BENTON HARBOR, MICHIGAN

New Products

Continued

4-WAY VALVE
. . . for 3000 psi circuits

Features: This new line of pilot operated, solenoid controlled 4-way valves is designed to be interchange-

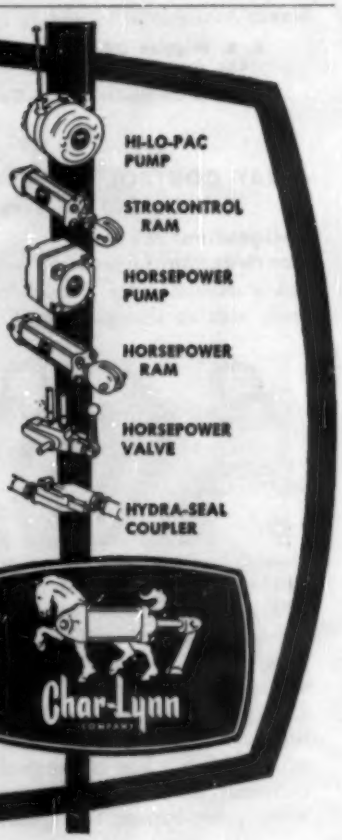
able with all comparable valves now in use. Pilot pressure can be external or internal and change-over is made simply by rotating the solenoid valve 180 degrees. A choice of spool types and spool positioning provides all the combinations needed for a wide range of applications.

Capacities: 20 gpm and 1¼ gpm

only HI-LO-PAC offers all these important features

HI-LO-PAC is a complete hydraulic system enclosed as a single unit.

Two pumps
Two valves
Filter
Pressure Relief Valve
Reservoir
200 to 1200 RPM
3 to 12 GPM
Up to 1000 PSI
Direct PTO Drive
Mounting Kits for all tractors



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HI-LO-PAC

America's leading power unit, serves on more than 200,000 farms daily, giving great service at low cost.

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CHAR-LYNN COMPANY

Dept. AH-11, 2843-26th Avenue South, Minneapolis 6, Minnesota

Hydraulic Horsepower To Serve You Better

for the ¾ inch pilot and ⅛ inch solenoid valves respectively.

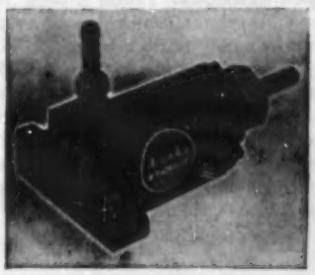
The Denison Engineering Co.
Columbus, Ohio

Circle 222 on Reader Service Card

SMALL AIR CYLINDER
. . . for clamping jobs

Designation: Model AC-1 x 1

Features: This clamp, latest addition to the Allenair line, has 1⅛



bore and 1 inch stroke, cast bosses for either horizontal or vertical mounting. For optional air inlet there are two ⅛ N.P.T. tapped holes at 90 degrees to each other. The piston rod is of stainless steel threaded on front end.

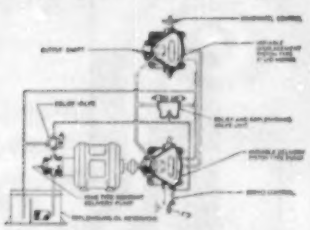
Applications: For use on many small jigs and fixtures where a clamping device is needed.

The A. K. Allen Company
Brooklyn, New York

Circle 223 on Reader Service Card

SPLIT HYDRAULIC TRANSMISSIONS
. . . for industrial applications

Design: Pump, motor and appropriate valving are combined to provide



a positive displacement type fluid power transmission having infinitely variable speed control. Pump and hydraulic motor have controls for output speed regulation and power characteristics. Acceleration and deceleration rates are independently adjustable. Simple-to-operate controls are easily installed, existing push-button stations can usually be modified and used.

Applications: For operations where

YOU REALLY HAVE COMPETITION NOW

AUTOMATIC TIMING

WILL
- SAVE TIME
- REDUCE REJECTS
- INCREASE PRODUCTION

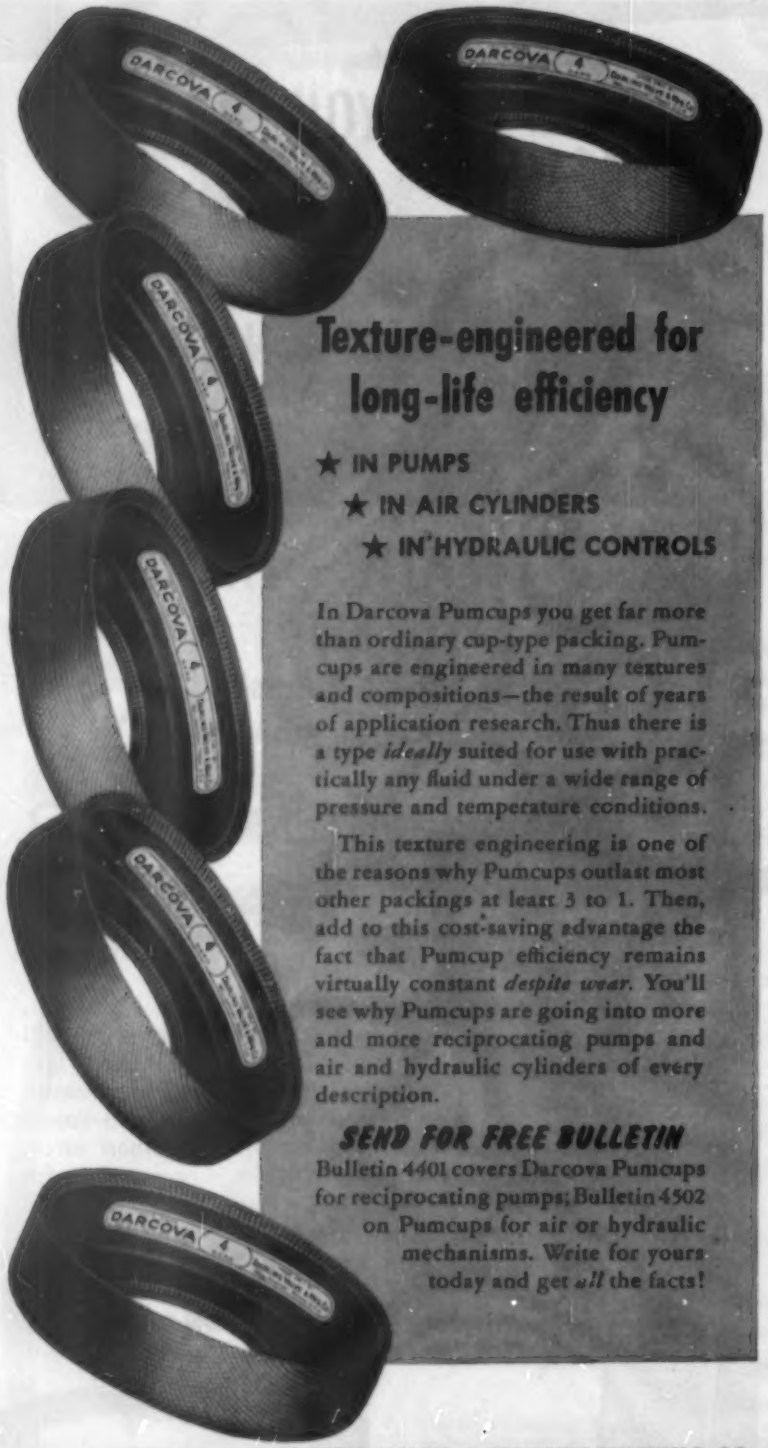
If you manufacture a product, quality timing or counting will control your processes with less wasted time . . . with increased precision . . . and will speed up production. The element of human error, increased with fatigue, often is responsible for trouble-making rejects. Eagle engineers will build a timer to answer your production problems. Send your problem today.

Write for FREE AUTOMATION BOOKLET "See What Timing Can Do For You"

Industrial Timers by EAGLE

EAGLE SIGNAL CORPORATION MOLINE, ILL.

Eagle Timers save time, save money.



Texture-engineered for long-life efficiency

★ IN PUMPS
★ IN AIR CYLINDERS
★ IN HYDRAULIC CONTROLS

In Darcova Pumcups you get far more than ordinary cup-type packing. Pumcups are engineered in many textures and compositions—the result of years of application research. Thus there is a type *ideally* suited for use with practically any fluid under a wide range of pressure and temperature conditions.

This texture engineering is one of the reasons why Pumcups outlast most other packings at least 3 to 1. Then, add to this cost-saving advantage the fact that Pumcup efficiency remains virtually constant *despite wear*. You'll see why Pumcups are going into more and more reciprocating pumps and air and hydraulic cylinders of every description.

SEND FOR FREE BULLETIN

Bulletin 4401 covers Darcova Pumcups for reciprocating pumps; Bulletin 4502 on Pumcups for air or hydraulic mechanisms. Write for yours today and get *all* the facts!

DARLING VALVE & MANUFACTURING CO.
Williamsport 15, Pa.

DARCOVA
THE ORIGINAL COMPOSITION CUP

PUMCUPS

New Products

Continued

special placement of the hydraulic equipment is desirable, such as separation of pump and motor to meet space limitations or solve alignment problems. Also offer advantages where drive requirements demand special combinations of a pump and more than one hydraulic motor.

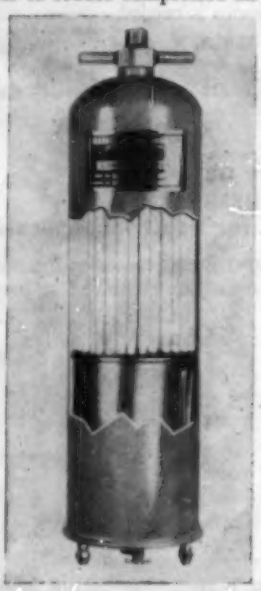
Specifications: Piston pumps for use with split transmissions are available in input ratings from .20-36.5 hp producing deliveries up to 58 gpm. Hydraulic piston type motors can be selected for output requirements from 3-25 hp. Duty can be continuous, intermittent or continuous reversing without shock. Standard A.C. electric motors are used.

Vickers Incorporated
Detroit 32, Michigan
Circle 224 on Reader Service Card

AIR FILTERS
. . . with disposable cartridge

Designation: M-30 and M-100

Features: Both models have a condenser to reduce compressed air dew



points. Rated at 30 and 100 SCFM respectively at line pressure of 100 psig, they have a new prefabricated steel case with a spun elliptical head that permits operating pressures up to 200 psig.

Operation: Compressed air enters the filter through the steel center shaft, passes into the spiral copper condensing section. The condenser re-

Circle 31 on Reader Service Card
Circle 94 on Reader Service Card →

Important...
to all **Hydraulic Engineers!**

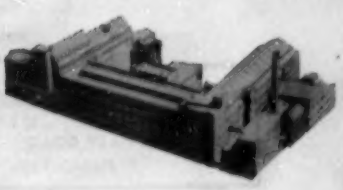
Pantex
¾" Pilot Operated 4-Way Valve
Remotely Controlled
100-5,000 p. s. i.

This compact wide-range, Pantex Valve can be manifold or sub-plate mounted and is available in six different spool types to meet varying requirements. Other features include:

Hollow Spool Design— gives true open center, provides flow through hollow spool to tank port, with both cylinder ports blocked, when spool is centered.

Versatility of Pilot Control— can be easily adapted to hand, cam, or other directional control operation.

Low Leakage and Rugged Construction— designed for maximum duty cycles, this valve —like all Pantex valves—is precision tooled to close tolerances.



Also available—

Relief Valves
350 — 5,000 p.s.i.

¼" Directly Operated 4-Way Valve
Solenoid Controlled
100-5,000 p.s.i.

¾" Pilot Operated 4-Way Valve
Solenoid Controlled
100 — 5,000 p.s.i.

... hydraulic control specialists ...

Pantex

MANUFACTURING CORPORATION
PAWTUCKET, RHODE ISLAND

since 1927

When the pressure's on

your best bet is ®

FLEX-O-TUBE

Supplied in Assemblies

Flex-O-Tube will help you determine the assembly needed or work to your own specifications. In either case, modern facilities and latest inspection techniques assure you a uniformly high quality product delivered promptly.

Supplied for Field Assembly

Flex-O-Tube hose is also supplied in bulk coils with reusable fittings for field assembly. Complete range of sizes and types.

If you use flexible hose in your product or for replacement in your plant, it will pay you to specify Flex-O-Tube. For here is a name that has stood for finest quality and dependable service for more than a quarter of a century.

In the development of new uses for flexible hose, Flex-O-Tube provides you with dependable experience in the field. When used for replacement in industrial maintenance, Flex-O-Tube provides you with a complete range of products that are easy to assemble and long on performance.

Whatever your needs, why not discuss them with the local Flex-O-Tube field engineer. You'll find there are many good reasons why industry has relied on Flex-O-Tube for miles and miles of flexible hose products.

Please send me your free ☐ aircraft catalog. ☐ industrial catalog.

Name .....

Company .....

City ..... Zone ..... State .....

Address .....

FLEX-O-TUBE

DIVISION OF MERIDAN CORP.

2527 JIM DALY ROAD • INKSTER, MICHIGAN

Flex-O-Tube Co. (Canada) Ltd., Windsor, Ontario

New Products

Continued

duces the temperature of the air to within 2 or 3 degrees of the cooling water temperature. Air then passes upward, through the cotton felt filter cartridge, reenters the center shaft and returns to the system. Condensed vapors drop into the condensate collection chamber, can be manually discharged or trapped to drain.

Hankinson Corporation
Pittsburgh, Pa.
Circle 225 on Reader Service Card

HYDRO-PNEUMATIC POWER UNIT
. . . applies 2½ ton force

Designation: The Hydro-Air Power Unit.

Design: Unit consists of three cylinders: one for fast, long pneumatic stroke, a second providing the 12-to-1 hydraulic multiplication of trapped oil pressure for the finishing stroke, and a third which is the booster cylinder to trigger the high pressure finish stroke. The booster cylinder is available in alternate sizes to offer either the regular or heavy duty finish pressure. Main stroke speed is adjustable by regulation of the air supply pressure, but does not influence decelerating characteristics. The extra hydraulic closing force at the end of the forward stroke is fully and independently adjustable.

Features: The device achieves its long stroke and fast operation through pneumatic cylinder action, and its powerful closing force through the differential hydraulic

piston principle, all in a single package driven by a small quantity of compressed air at regular plant utility pressures.

Specifications: Stroke is 7 inches, terminal force is either 2,100 or 5,600 pounds, weight is only 41 pounds, space requirements are less than 1 cubic foot, air requirement per cycle less than 0.11 cubic foot.

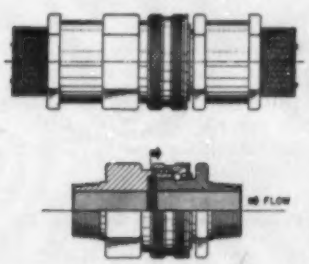
Applications: For use on machines where high closing force is required.

Pantex Manufacturing Corp.
Pawtucket, R. I.
Circle 226 on Reader Service Card

QUICK-SEAL COUPLING

. . . for high-pressure, heavy flow applications

Design: Made in several types for different methods of hose attachment—the female pipe thread, male pipe thread, expansion ring, or barb



shank type. All these types are interchangeable in the same size. Bearing surfaces in the coupling are heat-treated, ball bearings and springs are made of stainless steel.

Construction: Standard materials, unless otherwise specified, are cadmium plated steel with neoprene and Buna-N seals. Couplings are available in aluminum, brass, stainless steel and other alloys on request.

Features: The coupling's simple construction makes the hose line leak-proof the moment the nipple is seated in the coupling body, seals it tighter the higher the pressure builds up. It has a full swiveling action which prevents hose kinking.

Applications: Recommended for heavy industrial operations where hose line carries very large flow, where line pressure is high, or both.

Sizes: Available in a complete range up to 12 inches, including eight standard sizes from ¼ inch to 2 inch, and ten sizes from 2½ to 12 inches.

Titeflex, Inc.
Springfield, Mass.
Circle 227 on Reader Service Card

Electrol Hand Pumps for Uniform 2-Way Pumping Action

The Electrol 525 Hand Pump has a volumetric capacity of 1.5 cu. in. per cycle.

The Electrol 770 Hand Pump has a volumetric capacity of of 2 cu. in. per cycle.

Electrol Double-Acting Hand Pumps are capable of delivering uniform volume, with operating pressures up to 1,500 P.S.I. They are compact in design . . . have few moving parts . . . are low in cost . . . economical in operation. They have built-in suction and pressure check valves . . . ⅜" pipe thread ports . . . and can be used in mineral oil or water. Also, there are similar units available for use in gasoline, kerosene, or equivalent aromatic fluids. Complete engineering data can be obtained on request.

Electrol HYDRAULICS
KINGSTON, NEW YORK
Telephone, Kingston 1980

CYLINDERS • SELECTOR VALVES • FOLLOW-UP VALVES
CHECK VALVES • RELIEF VALVES • HAND PUMPS
POWERPAKS • LANDING GEAR DETOS • SOLENOID
VALVES • ON-OFF VALVES • SERVO CYLINDERS • TRANSFER
VALVES • CUT-OUT VALVES • SPEED CONTROL VALVES

Better Designed Products Use Electrol Hydraulics

Circle 42 on Reader Service Card

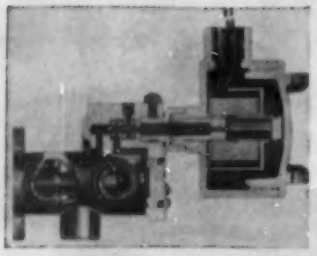
New Products

Continued

SOLENOID AIR VALVE
. . . eliminates coil burn out

Design: Extremely short solenoid stroke. Poppet design with linear sealing contact on resilient seats makes both pilot and main valve self scavenging.

Feature: Cover of explosion proof housing is removable for quick access to solenoids. Coils are interchangeable, making it easy to convert to any standard voltage by a simple coil change.



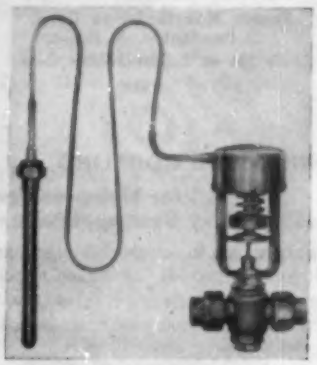
Application: Design particularly effective in dusty installations such as cement batching equipment.

Barksdale Valves
Los Angeles 58, California
Circle 228 on Reader Service Card

TEMPERATURE REGULATOR
. . . meets variety of conditions

Designation: #999 Regulator

Features: Regulator is self powered, requires no compressed air, electricity



or other outside source of energy. It's simple and sturdy in design and construction, frame is of stainless steel.

Applications: For use on industrial equipment requiring accurate temperature control, such as in oil hydraulic reservoirs.

Fulton Syphon Division
Robertshaw-Fulton Controls Co.
Knoxville, Tenn.
Circle 229 on Reader Service Card

HOOK SCALE
. . . is hydraulically operated

Designation: SU-20 Sensator

Features: Has a guaranteed accuracy of ¼ of 1 per cent capacity at any point on the dial.

Capacities: Available in 2,500, 5,000, 10,000 and 20,000 pounds.

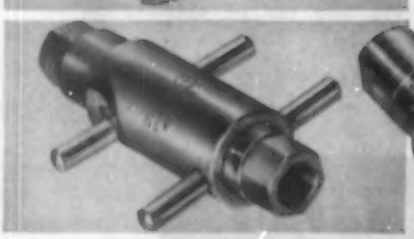
Martin-Decker Corporation
Long Beach, California
Circle 230 on Reader Service Card

for best performance—I recommend
DUKES New Hydraulic
BREAK AWAY
SELF-SEALING
COUPLERS

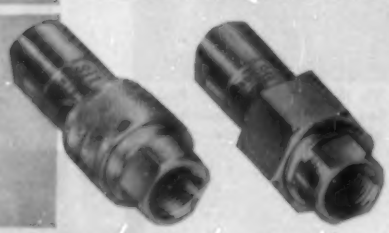
DUKES BREAK-AWAY COUPLER
Model 112 KS

Here's a break-away coupler that *does* couple with full pressure on both sides of the line.

- POSITIVE BREAK-AWAY ACTION
- POSITIVE SELF-SEALING
- NYLON VALVE SEATS
- SELF ALIGNING
- CAN BE MOUNTED *INDIVIDUALLY* OR IN *TANDEM*
- DESIGNED TO MEET EQUIPMENT MANUFACTURER'S REQUIREMENTS
- BUILT TO WITHSTAND HARD USAGE



Model HBC 100
IN LINE BREAK-AWAY COUPLER
No mounting brackets needed. Special *patented* compensating chamber allows recoupling by hand under full line pressure. Nylon valve seats assure positive sealing.



Model 302 KNURLED SLEEVE — Model 302-H HEX SLEEVE
DUKES IN LINE QUICK COUPLERS
For mounted equipment. Simplicity of design yet rugged construction assures satisfaction and ease of continuous operation. Nylon valve seats. Include all of above features except break-away action.

Manufacturers of Cylinders, Valves, Couplers and Fittings
"Member of the National Fluid Power Association"

DUKES COMPANY, Inc. 2108 N. Southport • Chicago 14, Illinois Phone: Diversey 8-6326

NOW
Leakproof
V-rings
Unique revolutionary design now makes possible, for the first time, a split V-ring packing that is really leakproof in operation . . . foolproof to assemble:
LINEAR VEE-DAM RINGS
POSITIVE SEAL AGAINST LABYRINTH FLOW
PREVENT LATERAL LEAKAGE
Smaller abutments on the outside shoulder edge of the ring, staggered in relation to the internal dams, prevent lateral leakage and also provide stabilizing support.
FOOLPROOF INSTALLATION
LINEAR VEE-DAM Rings are easy to install. Because they don't require the standard split-V-rings diagonal. Down time is reduced. Perfect joints are unnecessary.
LINEAR VEE-DAM Rings last longer, because they seal perfectly with minimum gland load. We're molding VEE-DAM Rings, in a choice of fabric-reinforced elastomers, individually engineered to your needs. Write or call for full information now!
PERFECTLY ENGINEERED PACKINGS
LINEAR
STATE ROAD & LEVICK ST., PHILA. 35, PA.

NEW BECKETT "HI-CYCLIC" SOLENOID VALVES

set highest industry standards for performance—long solenoid life—rapid maintenance.

New design improvements in Beckett "Hi-Cyclic" Valves greatly reduce or eliminate the most common causes for solenoid valve downtime. Solenoids are continuous duty, industrially accepted type, practically shock-free mounted for extremely long life. There is no metal-to-metal contact between solenoid and valve piston. Electrical connections are channeled through ½" NPT conduit outlet at the base of the valve. Quick disconnect electrical connectors are employed. Solenoid coil can be quickly removed without dismantling valve or disturbing electrical circuit. Tedious solenoid adjustment is eliminated.

SOLENOID VALVE DATA

These high performance valves are available in six sizes, ⅛" to 1" NPT in single solenoid, spring return, and double solenoid types. For operating on air or other non-corrosive gas (pressure range, 29.9" Hg. VAC. to 150 PSIG.) and oil or water hydraulics (max. pressure 1500 PSI.). Three-way and four-way, two-position and three-position. All common AC and DC voltages. Positive adjustable spring load on single solenoid. Adjustable flow control on air valves. Moisture-tight covers. All materials corrosion resistant. Changes from one model into another can be readily made in the field.

A *COMPLETE* VALVE LINE

"Hi-Cyclic" MECHANICAL VALVES—air and hydraulic—are available in six sizes, ⅛" to 1" NPT, actuated by hand lever, foot lever, fingertip lever, cam roller, piloted; 3-way and 4-way, 2-position and 3-position with detent and spring load to center on 3-position models. Also combinations of actuators.

"Hi-Cyclic" MANIFOLD-MOUNT VALVES—air and hydraulic—available in electrical and mechanical types listed above, in sizes ⅛" to ⅜" (modified) NPT sizes. *Made for automation*, manifold mounting permits fast replacement of all critical valve parts, including valve body and spool assembly, without disturbing piping, manifold block or electrical circuit.

WRITE FOR COMPLETE VALVE SPECIFICATIONS AND NAME OF NEAREST SUPPLIER

THE BECKETT-HARCUM COMPANY

1086 WAYNE ROAD, WILMINGTON, OHIO

USEFUL LITERATURE

PRESSURE SWITCH . . . for on-off control of aircraft and mobile pressurizing pumps is described in a catalog sheet available from United Electric Controls Company. The unit provides a positive switching action in response to source pressure variations independent of atmospheric pressures and temperatures. This control can be mounted by screwing it into a ⅛ inch National pipe thread opening. All features, applications, operation, electrical connections, outline dimensions, and adjustment are completely detailed. Ordering information is included.

Circle 158 on Reader Service Card

BOOSTERS, ACCUMULATORS . . . and air-hydraulic units are subject of an 8 page brochure released by Petch Manufacturing Company. The brochure also discusses air to oil and oil to oil cylinder type accumulators. Similar in application to bladder type accumulators but with the added advantage of a working pressure boost over the maintained back-up pressure. The well illustrated catalog features construction diagrams, circuits and a booster selector chart.

Circle 159 on Reader Service Card

GAGE GUARD . . . to protect sensitive pressure instruments is featured in literature offered by Industrial Engineering Corp. Installed simply in the line between the pressure instrument and the source of pressure, the unit is designed to cut off and prevent further pressure increase at the gage or manometer whenever the source of pressure exceeds the preselected cut-off point, and to withstand and hold closed up to 10,000 psig regardless of cut-off setting. The two available models are illustrated and complete engineering data listed.

Circle 160 on Reader Service Card

AIR DRIVEN HYDRAULIC PUMP . . . designed for small volume capacity at low and high pressures is the subject of a new data sheet offered by The Aldrich Pump Company. Available in either single or double acting models, the pump develops up to 30,000 psi at 90 psi air supply, provides for such applications as testing tubing, valves and pressure vessels, and sup-

You'll find many valuable production and design ideas in publications described here . . . copies will be sent you free without obligation

Continued from page 32

plying power for small molding presses. The data sheet gives complete information on design, installation, operation and is illustrated by photographs, sectional and dimensional drawings.

Circle 161 on Reader Service Card

LIQUID DRIVE . . . its advantages and uses are described in Liquid Drive Corporation's new 8 page catalog. A water operated unit, the variable speed liquid drive is composed of four functional elements, the impeller rotor, the runner rotor, the casings and the scoop tube. By means of positioning the scoop tube, an infinitely variable range of speed control may be obtained. The catalog lists typical applications, capacities, and dimensions, states that oil operated units are also available.

Circle 162 on Reader Service Card

HYDRAULIC HAND PUMP . . . for easy and efficient power application to hydraulic systems is detailed in a new 4 page bulletin. Published by Dowty Hydraulic Units Limited, the bulletin shows dimensional drawings, operational data and a sectional view of the unit. Literature states that with alternative connections and pressures variable from 500 to 4,000 psi, the pump can be adapted to suit a wide range of individual requirements. The pump is double acting and creates pressure at each stroke of the handle. Operational setting of the handle is adjustable to any angle.

Circle 163 on Reader Service Card

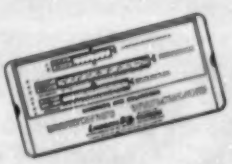
SOLENOIDS . . . of a newly designed line, manufactured by Joseph Pollak Corporation are described in a new catalog. Light-weight and compact in design, the solenoids are available in a wide variety of mountings, coils and wire sizes. Three hundred different types of custom solenoids may be assembled from twenty standard parts. An unusual feature of this line, series 100 and 300, is simplified change-over to push or pull type by adding a threaded 3/32 inch diameter push rod to any plunger. The catalog includes performance curves and typical coil data.

Circle 164 on Reader Service Card

Lindberg Air or Hydraulic Cylinders provide dependable, low cost power for lifting, forcing, pulling, pressing, pushing and clamping.

If you need special cylinder installations . . . tough jobs that require extra engineering skills and efforts . . . Lindberg's long experience and established know-how will give you the right answer. Lindberg makes a full line of standard cylinders, too. Ask for our bulletin No. 800.

Write for new Cylinder Calculator



You'll find this a helpful, time-saving tool for both air and hydraulic computations. In slide rule form, it provides air and hydraulic design data to make selection of proper cylinders and other air or hydraulic equipment quick and easy. Just write us for it. No obligation.

LINDBERG AIR..HYDRAULIC DIVISION

A DIVISION OF LINDBERG ENGINEERING COMPANY

225 North Laflin Street, Chicago 7, Illinois

Circle 74 on Reader Service Card

Now Ready!

A Beginner's Course in Basic Pneumatics

A complete reprint of the popular "Beginner's Course in Basic Pneumatics" in permanent form.

The material has been enlarged and rearranged; two indices, one of Tables and Charts, have been added. Basic data on principles as well as components is easy to run down.

The first source for individual reference and study as well as a practical text for company pneumatic training programs.

"A Beginner's Course in Basic Pneumatics" is designed for the man who needs quick, positive orientation in fundamentals. It is the first volume to give systematic attention to the principles and basic equipment of industrial pneumatics.

$1.00

$1.00 per copy, postpaid
20-99 copies 90 cents each
100 or more copies 80 cents each

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Please send ..... Copies of "A Beginner's Course in Basic Pneumatics"
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USEFUL LITERATURE

SYNTHETIC PACKINGS . . . made of Kelon, a new fluoroplastic material that provides many important advantages in applications of adverse chemical, electrical and physical environments are discussed in a 4 page two-color catalog offered by W. S. Shamban & Co. Spiral back-up rings, O-rings, V-seal packings, piston seals, grommets and scraper rings manufactured from this new material have many industrial and aircraft applications. The company's modern facilities are also described.

Circle 165 on Reader Service Card

ELECTRIC MOTORS . . . manufactured by U.S. Electrical Motors Inc., are featured in a new multicolored booklet. It presents the 20 principal types, including uniclosed, totally-enclosed, explosion proof with and without fan, combination variable speed and internally geared units. Cutaway views of Varidrive and Syncrogear types are shown in full color. Also given are details on Lubriflush transverse bearing lubrication, asbestos-protected windings and normalized motor castings.

Circle 166 on Reader Service Card

AIR-MITE AIR CYLINDERS

Low Cost . . . Compact . . . Powerful . . . Rugged

AIR-MITE Cylinders—made in single or double acting series—in 4 mounting types, are high quality cylinders at a low price. Simple, rugged design and compact construction give them long life, permit easy mounting on jigs, fixtures, tools, or machines. Used wherever power holding, pushing, pulling or lifting is required, AIR-MITE cylinders will meet your most exacting standards of dependability and long life. Write for complete catalog and prices.

1. Ground and polished steel ram
2. Brass, true-bore cylinders
3. High strength aluminum alloy cylinder heads
4. Bronze oilless ram bushing
5. Five steel tie rods
6. Brass hose stems

4 Mounting Types

AIR-MITE Devices, Inc.
4415 W. CARROLL AVENUE • CHICAGO 24, ILLINOIS

Circle 4 on Reader Service Card

HYDRAULIC POWER UNIT . . . previously offered in pressure ranges from 250 to 1000 psi is now available in higher pressure ranges, from 1200 to 2000 psi. Manufactured by Logansport Machine Company, Inc., they describe the engineering changes of the unit, Model 6031, in a new catalog which shows complete data.

Circle 167 on Reader Service Card

AIR VALVES AND CYLINDERS . . . A catalog of detailed drawings which show all dimensional and construction features of their products is offered by Air Power Inc. Single and double acting tie-rod type cylinders are shown. Some models are shown with telescoping protective sleeves over the piston rod. Other drawings show details of quick release valves and poppet valves for directional control of cylinders.

Circle 168 on Reader Service Card

"FOR GREATER EFFICIENCY" . . . is title of booklet featuring shock and vibration isolators. The bulletin, prepared by Barry Corporation, discusses the problems of greater utilization of capital equipment, methods of pin-pointing and overcoming sources of inefficient plant and machinery operation. Based on an extensive survey, literature discusses eight steps in attaining efficiency objectives.

Circle 169 on Reader Service Card

SLIDERULE CALCULATOR . . . for selecting air hydraulic cylinders is available from Air and Hydraulic Division, Lindberg Engineering Company. A time saving tool it provides quick information on cylinder diameters, areas, pressures, forces and displacements.

Circle 170 on Reader Service Card

CHAIN DRIVES . . . for 50 to 5,000 hp drive applications are outlined in a six page catalog folder available from Morse Chain Company. The folder, which is water and oil-proof plastic material, has complete line drawings and descriptive material dealing with such subjects as sprocket installation, chain assembly, chain cases, lubrication, chain disassembly and maintainance procedures. The folder describes in detail disassembly procedures for both washer-type and spring-lock type connecting links.

Circle 171 on Reader Service Card

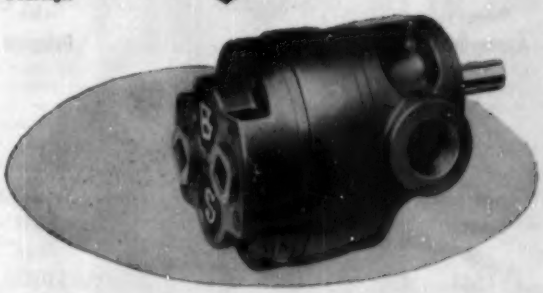
AIR RELEASE VALVES . . . manufactured by The V. D. Anderson Co., are described in condensed bulletin No. 654. The data sheet gives complete information on three different styles of air release valves used for venting air from liquid lines and tanks under pres-

For top performance under pressure

...8 Pumps for Your Hydraulic Systems

Nos. 53 and 55 for Pressures to 200 psi
Two pump sizes with capacities of 4 to 23.3 gpm and 9 to 34.1 gpm at 0 psi respectively — high-efficiency helical gears — anti-friction bearings.

The 500 Series for Pressures to 500 psi
Six pump sizes with capacities from 5.1 to 37.6 gpm at 0 psi — precision gears — long-lived needle bearings.



Here's the smooth, trouble-free way to pump large volumes of oil at high speeds. These eight Brown & Sharpe Pumps are rotary-geared for positive, reliable action . . . mechanically sealed for leak-proof operation. They've proved themselves in thousands of hydraulic installations. Find out what they can do for *yours*. Write for new Pump Catalog No. 35P. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

BUY THROUGH YOUR LOCAL DISTRIBUTOR

BS
Brown & Sharpe

Circle 22 on Reader Service Card

What a sight!
CENTURY'S All-new Oil Level Sight Gage

No Easier Installation Ever Designed

Better Visibility at any Height

Streamlined Modern Appearance

Leak-proof —No Dripping

Important Savings in COST

Available NOW From STOCK!

Inquire today . . . make immediate use of the sensational advantages in cost and services offered by this new gage . . .

CENTURY HYDRAULICS, INC.

8866 GREENFIELD — DETROIT 28, MICHIGAN

USEFUL LITERATURE

sure. The standard Silvertop air release valves are made in six sizes, from ½ inch to 2½ inches for pressures up to 250 psi; the forged steel for use on high pressures up to 500 psi is made in three sizes with pipe connections from ½ inch to 2 inches; and the No. "O" valve, made in ¾ inch size only for a maximum pressure of 150 psi, are fully described. Also included is a capacity table showing the cubic feet of free air handled by various valves at different operating pressures.

Circle 172 on Reader Service Card

TRANSMISSION BELT . . . known as Poly-V drive is discussed in a new brochure, #6638, available from Raybestos Manhatten's Rubber Division. Design characteristics of the single, endless belt with molded lengthwise ribs, are explained in two-color line drawings which show why fourteen specific advantages are claimed for the drive. The brochure uses V-belts and sheaves as a standard for comparison of Poly-V with conventional drive. Text and illustrations show in detail why the drive gives twice the contact area, 50 percent more horsepower, eliminates matching and reduces inventory of belts and sheaves.

Circle 173 on Reader Service Card

conform to J. I. C. standards

RUGGED . . .

Where it counts most!

CARTRIDGE . . . metallic rod-wiper, packing, bushing in one unit.

RUGGED BODY . . . all steel end caps and barrel.

PISTON RINGS . . . step-cut joint, long life, minimum leakage.

PRESSURE . . . 2,000 psi heavy-duty . . . 3,000 psi non-shock.

SIMPLICITY . . . no tie-rods . . . no retainer rings.

hydro-line *Manufacturing Co.*

8808 PIKE ROAD • ROCKFORD, ILLINOIS

Circle 25 on Reader Service Card

Circle 65 on Reader Service Card

PACKINGS . . . are the subject of a comprehensive circular showing diagrams and tables dealing with homogeneous, leather and fabric V-packings, homogeneous synthetic rubber U-cups and fabric cup packings. Molds have been developed whereby the V-packings of the 3 types are completely interchangeable with one another without upsetting the overall stack height of the set of packings. Bulletin No. 207 is available from Chicago Belting Co.

Circle 174 on Reader Service Card

HYDRAULIC CONTROL VALVES . . . Eight new hydraulic control valves with ball detent for position locking are discussed in catalog sheets, a section of Catalog No. 200, issued by Logansport Machine Company. Included are six 3-position, 4-way valves and two 2-position 4 and 3-way valves.

Circle 175 on Reader Service Card

CENTRIFUGAL PUMPS . . . in ranges from ⅛ to ¾ hp, from 6 to 65 psi and handle up to 70 gpm are described in a 12 page catalog prepared by Eastern Industries, Inc. The pumps are close coupled to provide greater strength, and to reduce size, weight to a minimum. To assure perfect alignment the pump shaft is threaded into the motor armature shaft. This easy to read catalog offers helpful engineering data, specifications on all models, performance diagrams, dimensional drawings, instructions on stuffing boxes and mounting diagrams.

Circle 176 on Reader Service Card

REMOTE CONTROLS . . . for controlling hydraulic valves, winches, charging cranes, slitting machines and other remote control uses are shown in a bulletin available from Trimount Instrument Company, Crown Control Division. Graphs and specification point out some improvements made on the MAT type. Also shown in the bulletin is complete data on the MAR type control which is a gravity feed unit.

Circle 177 on Reader Service Card

AIRCRAFT HOSE AND HOSE ASSEMBLIES . . . for use in oil, hydraulic and fuel systems are described in a 16 page catalog published by Resistoflex Corporation. Also featured are high temperature, extra light weight, chemically inert, corrosion-proof hose and assemblies for aircraft and special industrial use. The catalog gives sizes, operating data, construction features, servicing information and a table of standard fittings.

Circle 178 on Reader Service Card

AIR COMPRESSOR . . . of the Utility 105 cfm type has been placed back into the compressor line manufactured by Le Roi Company, after an absence of several years. A bulletin describes the new and improved features, better air cleaning and cooling through

tough, flexible CaPlugs insure dirt-free arrival of Alemite Accumeter Valves

Furnished as a key component of an Alemite Accumeter Centralized System for machine lubrication, this tiny, accurate valve must be kept dirt and grit-free during shipment . . . *and it is!* Easily-applied Tapered CaPlugs seal all three openings.

Says Stewart-Warner Corp., manufacturer of Alemite Systems, "All of our equipment that is tested on the assembly line is capped or plugged with CaPlugs. . . . They also help impress the customer with the steps that have been taken to protect the equipment and convince him of the continuing need for protecting lubricants against contamination."

Molded of tough, flexible Polyethylene, CaPlugs are impervious to all common chemical reagents, acids and solvents. They will not chip, break or shred under most severe conditions.

Furnished in five standardized designs, CaPlugs are stocked in over 100 sizes to meet most requirements. Write for catalog, price lists and free CaPlug assortment.

CaPlugs

DIVISION

PROTECTIVE CLOSURES CO., INC.

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TAPERED CAPLUGS
For use as caps or plugs, inside or outside of threaded or plain fittings.
SC SERIES
Thread-protecting dust caps for electrical connectors. Fit over threaded or plain fittings.
CD SERIES
Threaded seal and shipping caps. Knurled for ease of application.
PD SERIES
Threaded Plugs for aircraft and hydraulic tube fittings. Seal beyond ordinary requirements.
NEW SERIES SC SLEEVE CAPS NOW AVAILABLE

Circle 102 on Reader Service Card

Circle 112 on Reader Service Card

UNBRAKO

dryseal-thread

PRESSURE PLUGS

seal tight

without compound

When UNBRAKO Pressure Plugs are tightened, major and minor diameters are positively sealed, pressure tight without sealing compound. UNBRAKO Dryseal-Thread Pressure Plugs, in a full range of sizes from ⅛" to 1¼" NPTF, are available from your local UNBRAKO distributor's stocks. Write for literature. STANDARD PRESSED STEEL Co., Jenkintown 2, Pa.

UNBRAKO SOCKET SCREW DIVISION SPS JENKINTOWN PENNSYLVANIA

USEFUL LITERATURE

the use of oil bath air cleaners and a pressurized cooling system. Installation drawings show the width is 25 inches and the length only 82 inches. Photos show the compressor with and without removable lightweight expanded metal hood sides. Specifications for the compressor and engine, as well as a complete rundown on tool capacities are included.

Circle 179 on Reader Service Card

RUBBER AND LEATHER PACKINGS . . . Six new technical bulletins, each featuring essential data on individual types of packings have been issued by E. F. Houghton & Co. Compiled to save time for designers, engineers and maintenance departments, each bulletin contains factual information and standard sizes for only one specific style of packing. The leaflets on leather packings also include data on new rubber impregnated leather.

Circle 180 on Reader Service Card

ELECTRIC MOTORS . . . Performance tests of different brands of electric motors and their results are published in a 4 page brochure. Offered by The Electro Dynamic Motor Generator Division of the General

A New Gresen Product

DIFFERENTIAL RELIEF VALVE

Of Greater Capacity

Model D75

The Quality Valve At Mass Production Prices.

Features

★ Grey Cast Iron Body

★ Hardened Steel Plunger and Seat

★ Smooth Operating Pressure Regulating Screw

★ Light Spring Has Long Life and Low Stress

Pressure Range: 50 to 1250 P.S.I.
Capacity: 24 G.P.M. @ 15 ft/sec

Relief valve of smaller capacity available in our Model DR75.

Write for Literature

GRESEN MANUFACTURING CO.

620 Colfax Ave. N. Dept. H-93 Minneapolis 11, Minn.

Circle 93 on Reader Service Card

Circle 54 on Reader Service Card

Dynamics Corporation, the booklet presents the information in tabular form for engineering performance, and comparison, in visual color charts, as to what the results prove in relation to use.

Circle 181 on Reader Service Card

HYDRAULIC COMPONENTS . . . motors, gear-type pumps, valves, cylinders, valve and pump combinations for up to 1000 psi working pressure are presented in a catalog available from Wisconsin Hydraulics, Inc. The motors and pumps in a number of mounting variations are available in sizes ranging from 8 to 22 gpm. Large diameter single and double acting cylinders, in sizes from 5 to 8 inch diameters, are shown together with operating pressures and dimensions in convenient chart form.

Circle 182 on Reader Service Card

OIL FILTERS AND PURIFIERS . . . illustrated in a new bulletin, demonstrates how these units are presently used and suggests additional and similar applications in pipe line and industrial fuel and lubricating oils. Prepared by Purifier Division, Hilliard Corporation, the bulletin describes newer installations for lubricating and non-lubricating oils in transformers, circuit breakers, heat treating, wire drawing and hydraulics.

Circle 183 on Reader Service Card

HAND TACHOMETERS . . . Metron Instrument Company's new bulletin covers the new 3 in 1 hand tachometer which dependably measures the speeds of rotating parts and moving surfaces. The 3 in 1 has three separate ranges in one instrument. Only one range appears at a time, therefore minimizing reading errors. Ranges are selected by merely flipping a handy switch. There is no fear of damage due to overspeeding or selection of the wrong range.

Circle 184 on Reader Service Card

VALVES AND FITTINGS . . . manufactured by the Kohler Co. are described and illustrated in a new 20 page catalog. It features hydraulic check valve, hydraulic relief valve, hydraulic restrictor valve, pneumatic check valve, swing check valve, needle valve and plug valve. All the controls are shown in diagram drawings, sizes and engineering data is tabulated.

Circle 185 on Reader Service Card

O-RINGS . . . for general industrial hydraulic fluids as well as water and air service are illustrated in a new four page folder. Manufactured by Stillman Rubber Co., these O-rings are precision molded of Buna N fuel and oil resistant compounds. They are available in a complete range of standard sizes, and special sizes for industrial use.

Circle 186 on Reader Service Card

Prevent
Sludging
Pump, valve and piston failures
with
HILCO

HYFLOW OIL FILTERS
• ***STRAIGHT MICRONIC FILTERING***

SERIES "R" FILTER

RECLAIMER

OIL RECLAIMERS
For FILTRATION Plus WATER and MOISTURE REMOVAL

Oil contamination is one of the largest single causes of hydraulic equipment failure. Eliminate dirty oil with HILCO Purification . . . keep your oil clean by removing products of oxidation, acids, sludge and moisture. Increase the life of your oil and cut costly downtime with HILCO Purification.

Years of experience and dependable service make **HILCO** your best filter buy.

★ ***Recommendations at No Obligation***
FREE Descriptive Bulletin

THE HILLIARD CORPORATION
240 W. FOURTH ST. • ELMIRA, N. Y.

IN CANADA: — Upton - Bradeen - James, Ltd.
890 Yonge St., Toronto — 3464 Park Avenue, Montreal

Circle 57 on Reader Service Card

Post Scripts of Industry

News about people, manufacturers and sales organizations

Frank R. Helfrich
Precision Rubber Products Corp.

Frank R. Helfrich has been named manager of the Cleveland, Ohio Branch Sales Office of **Precision Rubber Products Corporation.** Prior to this appointment he was product development manager of Neff-Perkins Company. Helfrich has had ten years sales engineering and industrial market research experience in the rubber and plastics field.

Nicholas N. Solovioff
Greer Hydraulics, Inc.

Nicholas N. Solovioff was appointed to the operational staff of **Greer Hydraulics, Inc.** According to Edward M. Greer, president of the company, Solovioff will head the newly formed production engineering department. He will act as liaison between engineering and manufacturing departments in effecting simplification and standardization of production methods. As pilot, designer, inventor and manufacturer, Solovioff has been closely connected with the aviation industry, holds many patents for aviation components, systems and navigational instruments.

R. W. Powell
Hydraulic Press Mfg. Co.

R. W. Powell was appointed general sales manager of **The Hydraulic Press Manufacturing Co.'s** Machinery Division. Associated with H-P-M for 18 years, Powell has been sales manager of the plastics machinery division since 1949. H-P-M's machinery division includes the metal working and process press division, plastics machinery division and the die casting machinery division.

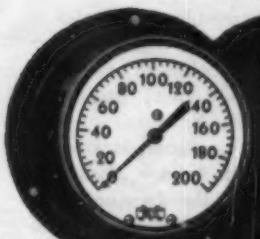
Electro Dynamic Motor and Generator Division, General Dynamics Corporation, appointed **James A. Setchell Company** to handle sale and service of their motors and generators in the State of Arizona.

Larry Hansen, vice president in charge of sales, **The Hansen Manufacturing Co.,** announced the appointment of **Zopf Engineering Co.,** 214 E. 39th St., Kansas City, Mo. as representatives. **Kent B. Zopf** is head of the company which will engineer, sell and service the Hansen line of fluid couplings in Kansas, Nebraska, the western half of Missouri and the western one-third of Iowa.

Overstreet & Kininmonth Company have been named exclusive agents in Arizona and New Mexico for the **Rucker Company.** The Phoenix company will handle the Rucker line of industrial and agricultural hydraulic units and components. The company is headed by **Reading Overstreet** and **Arthur S. Kininmonth.**

J. H. Stickney, sales engineer in northern Indiana for **Parker Appliance Company,** was named sales engineer for Parker O-rings and related rubber products in northern Indiana, central Illinois, the entire states of Wisconsin and Minnesota. **Rockford Tool & Transmission Co.,** 802 Broadway, Rockford, Illinois was appointed

Circle 81 on Reader Service Card



THE *Right* GAUGE FOR YOUR SPECIFIC NEEDS

MARSHALLTOWN

• Available in a wide variety of general purpose and special purpose gauges in pressure ranges to meet your specifications in every particular.

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PRESSURE, VACUUM, COMPOUND, ALTITUDE, COMBINATION, DIAPHRAGM, HYDRAULIC, AND SPECIAL PURPOSE GAUGES, DIAL THERMOMETERS, (VAPOR TENSION OR BI-METAL)

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It's packed with ideas for product designers ... a completely new edition of the booklet

"APPLICATION IDEAS"

by

GAST

showing actual practical O.E.M. applications like this...

For Gast rotary AIR MOTORS
... 1/20 to 4 h.p.
... 100 to 6,000 r.p.m.

COMPRESSORS
... up to 30 p.s.i.
... ½ to 24 c.f.m.

VACUUM PUMPS
... up to 28 in.
... ½ to 24 c.f.m.

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Original Equipment Manufacturers for Over 25 Years

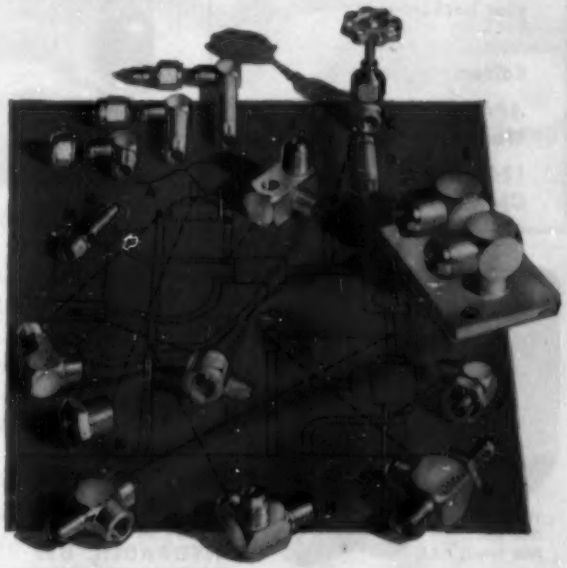
GAST ROTARY — AIR MOTORS • COMPRESSORS • VACUUM PUMPS
(TO 4 H.P.) (TO 30 LBS.) (TO 28 INCHES)
GAST MANUFACTURING CORP., 131 Hinkley St., Benton Harbor, Mich.

Circle 49 on Reader Service Card

Connect up with L and L

The Complete Line of Steel Fluid Power Couplings

JIC Flare Tube — Pipe Threaded
Flare Tube — Straight Thread "O" Ring
Flange Mounted — "O" Ring Seal



A—JIC Flare Tube Fittings	G—Ball Check Valve
B—Manifold Fitting	H—Lateral Outlet Fitting
C—Needle Valve	I—Universal Elbow
D—Pipe Nipple	J—Dryseal Pipe Fitting
E—Flange Manifold	K—Hex Reducing Bushing
F—Straight Thread, "O" Ring Seal Fitting	L—Swivel Elbow
	M—Barbed Hose Stem

You can depend on L & L's quality, availability, and selection of steel couplings for piping all industrial hydraulic circuits.

Distributors in principal cities
Write for catalog No. 53

L and L MANUFACTURING COMPANY
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Circle 72 on Reader Service Card

Wanted

Associate Editor for APPLIED HYDRAULICS Magazine

We are looking for a man who can gather material, edit and write articles. It is necessary to be familiar with the design, application and maintenance of air and oil powered machinery.

If you believe that you can qualify for this position, write a letter telling about your background.

Editor
APPLIED HYDRAULICS Magazine
1240 Ontario
Cleveland 13, Ohio

Post Scripts of Industry

distributor for hydraulic hose fittings and hose assemblies. Lowell Spurgeon, vice president of Rockford Tool states his firm will maintain stocks of hose fittings and tube fittings, and will service customer requirements in upper Illinois and southern Wisconsin.

Flex-O-Tube Division Opens New Plant

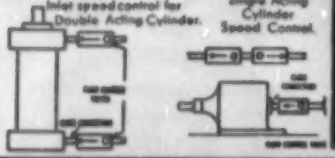
Designed for efficiency of operation, Flex-O-Tube Division of Meridan Corporation, has completed its move into the new plant located on a 10 acre tract in Inkster, Michigan. W. W. Wasson, the division's vice president and general sales manager, pointed out that this new single level operation will permit a 50 per cent production increase. Together with its additional equipment, the company will be able to broaden its product lines within the general field of hydraulics and flexible hose assemblies. The new plant contains 52,000 sq ft of space, but is designed to permit future expansion to 300,000 sq ft.

Get Easier, More Accurate Cylinder Speed Control with Pneu-Trol VALVES IN AIR OR HYDRAULIC USE

3000 and 5000 (steel) P.S.I.

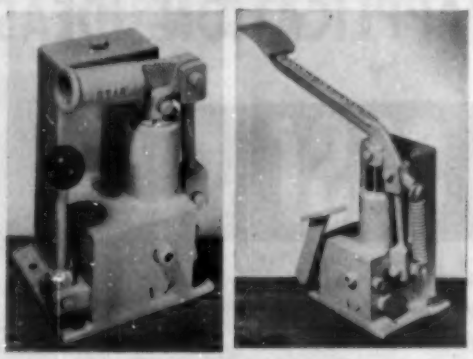
Pneu-Trol Valves combine in a short, compact body, a tapered fine thread needle for extremely accurate air or oil flow control and a floating retro ball check, which permits full flow in the opposite direction. Retro ball floats in most sensitive position to seat, requiring only a slight differential pressure to fully open or close it. Check Valve and Needle Valve incorporate single function features of Flow Control Valve. All valves available in 5 female pipe sizes—⅛" to ½". Valve bodies are made from brass, aluminum, steel or stainless steel. Attractive Prices—Imediate Delivery.

Write for Illustrated Circular and Price List.



Pneu-Trol Devices, Inc.
1426 N. Keating Ave., Chicago 51, Ill.

STAR Hi-Lo **TWO SPEED CONCENTRIC PUMPS**



- **HAND AND FOOT OPERATED**
  Two speed construction provides automatic change over during operating cycle from high speed low pressure to low speed high pressure.
- **MAXIMUM CAPACITY 10,000 P.S.I.**
  Safety overload valves—Hard chrome plated pistons—Piston stroke 1½ inch—Oil capacity 150 cu in or larger—3 models (½"-⅞") (½"-1¼") (½"-1½")

Representative areas available

Star Jack Co. *River Grove, Ill.*

Circle 100 on Reader Service Card

Circle 114 on Reader Service Card

Island Machinery Company, Farmingdale, Long Island, will handle sales, installations and service for **True Trace Sales Corp.,** El Monte, California. Island Machinery Co. has set up a wholly owned subsidiary known as True Trace Eastern, will cover the East coast of the U.S. **International Machinery Company, Ltd.,** Hamilton, Ontario, has been appointed True Trace's representative throughout Canada.

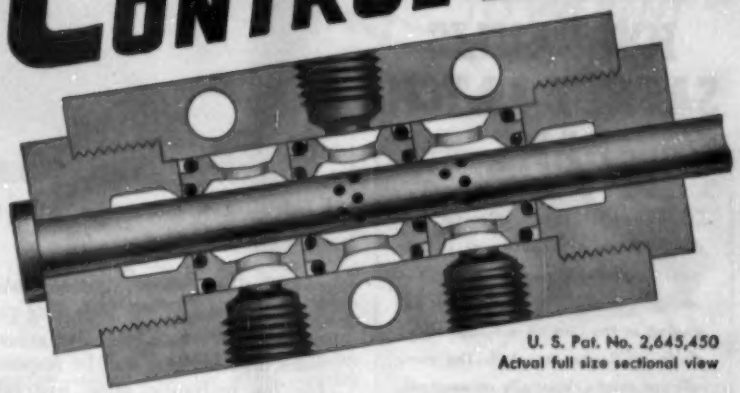
Harold J. Mock
Adel Precision Products Div.

Harold J. Mock was named executive vice president of General Metals Corporation and general manager of its **Adel Precision Products Division.** Mock was director of guided missile manufacturing for Hughes Aircraft Company, and before coming to California in 1950 was director of industrial engineering for Ford Motor Company.

Charles W. Bowden, Jr. succeeds D. M. Considine as market extension manager of the **Industrial Division of Minneapolis-Honeywell Regulator Company.** With the company since 1946, Bowden's new duties will include direction of the division's advertising and merchandising programs, its technical and trade publication editorial activities. **John H. Hagen** has been named director of industrial relations for the Brown Instruments Division. He has been with the parent company since 1933.

NEW, INEXPENSIVE, HIGHLY EFFICIENT

Quick-As-Wink®
CONTROL VALVE



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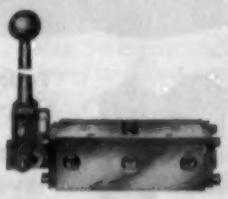
Actual full size sectional view

COMBINES greatly simplified construction, positive positioning of all parts, and quick and easy repacking in the field.

• Internal spacers are held firmly and accurately in metal to metal end abutment when the gland nuts are tightened, holding the "O" rings in correct position, without subjecting them to any mechanical pressure. Flow is from the inlet chamber through the hollow, radially ported, stainless steel plunger, and out the connected line. No direct impingement of flow across the packings, greatly prolonging their life. ⅛" or ¼" pipe connections. 2, 3, 4 or 5-way actions. Push-pull; push, spring return; lever; foot; cam; pilot; diaphragm and single and double solenoid designs. Write for Bulletin No. 531 today! *It gives full details.*

Ask us also about...

PILOT CYLINDER HYDRAULIC VALVE pressures to 5000 psi. Usually placed close to the work and controlled with an easily operated and conveniently located air valve.



SINGLE PLUNGER AIR VALVE, ⅜" to 1½" sizes. Widely used for controlling single and double acting cylinders and as pilots for other valves

Quick-As-Wink
AIR AND HYDRAULIC
Control Valves

Hand, Foot, Cam, Pilot, Diaphragm and Solenoid Operated

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Circle 99 on Reader Service Card

HYDRAULIC SAFETY LATCH RAMS

(PATENTED)

"Hydro-Latch" Remote Control Hydraulic Rams of capacity or size to meet any requirements with built-in spring loaded safety latch, self-engaging as the ram travels out—either clevis or flange mounted. The rams will not rotate. Manually or mechanically operated. Standard size: 10 tons, 7 inches of travel. We solicit inquiries to fit your application.

WILLIAM S. PINE
1635 E. 22nd St., Los Angeles 11, Calif.

Post Scripts of Industry

R. G. Ralph W. F. Slater Ray Elner

C. J. Coberly, president of **Kobe, Inc.**, announced the following promotions. **W. F. Slater,** to general sales manager. He will be responsible for hydraulic sales, hydraulic service pipe processing sales, industrial and export sales at the Oklahoma plant. **R. G. Ralph,** to hydraulic service manager, heading service and field shop operations. **Ray Elner,** to hydraulic sales manager, having overall charge of hydraulic pump equipment sales at Huntington Park. **J. T. Lewis,** to Southern Division sales manager, succeeding Elner. **S. S. McDonnold** will take over the post as West Texas District sales manager vacated by Lewis.

Prominent User Acclaims

"M-B" Automatic Air Line FILTER, REGULATOR and LUBRICATOR Assembly

The value of "M-B" Automatic Air Line Filters, Regulators and Lubricators is widely known for their effectiveness as a protection to Air Valves, Cylinders, Pneumatic Tools, etc.

"Your 'Sentinel of the Air Line' has been giving us very good service. We have had no complaints at all and I trust that we will be ordering more of them in the near future."

signed: **A. E. Cranston, Sr.**
PRESIDENT
Cranston Steel Strapping Co.
Oak Grove, Oregon

Write for Literature

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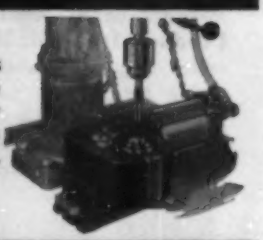
Division of Tool Sales Co.
46 Victor Ave., Detroit 3

New AIR-OPERATED **LYNAIR COLLET CHUCK**

Reduces Overhead . . . Assures Greater Profits . . . Positive Holding . . . Versatile . . . Speedy Operation . . . Positive Depth Control . . . No Chip Problem . . . Wide Capacity Range.



AIR AND HYDRAULIC CYLINDERS

A full line of mounting styles. Airdraulic Cylinders . . . Boosters. Complete engineering facilities for special application units. Write for literature and full information.

LYNAIR, INC., Jackson, Michigan

Circle 83 on Reader Service Card

Circle 79 on Reader Service Card

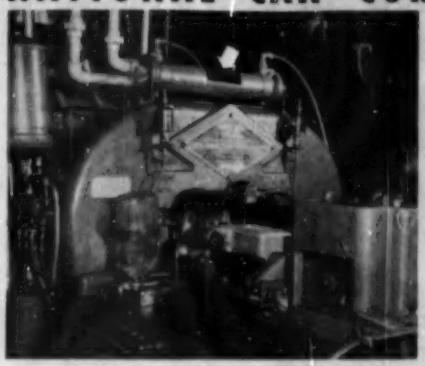
Quaker Rubber Corporation, Division of H. K. Porter Company, Inc., named **Joseph Cleary** as plant engineer. He will be responsible for the specifications and design of all new equipment, maintenance and repair of present plant facilities.

Distributor Sales Company, Cleveland, was appointed a stocking distributor of **Stratoflex, Inc.,** Ft. Worth, Texas, for industrial and aircraft reusable hose.

The first International Sales Meeting of the **Bellows Co.** was held at the Mayflower Hotel, Akron, Ohio, September 13-15. The entire field engineer force and key personnel of The Bellows Co., The Bellows Co. of California, and Bellows Pneumatic Devices of Canada, Ltd., were called into the home office to see and hear plans for the future. All product information was thoroughly covered, orders, credits, billings,

Circle 132 on Reader Service Card

NATIONAL CAN CORPORATION USES



YOUNG HEAT EXCHANGERS TO PREVENT BEARING FREEZE-UPS!

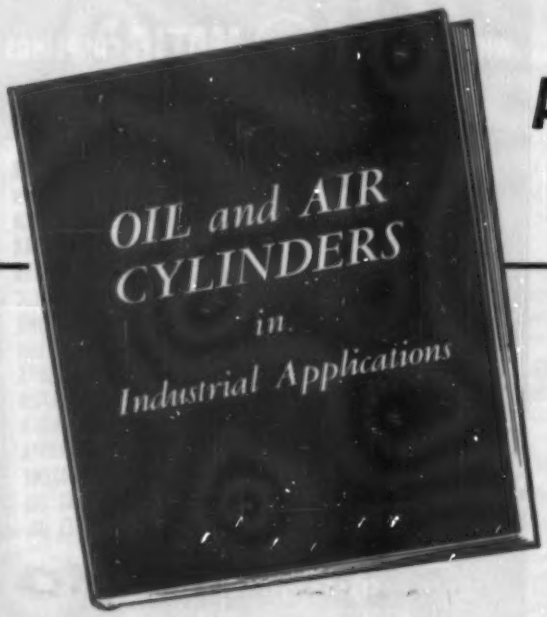
NATIONAL CAN CORPORATION uses Young oil-to-water Heat Exchangers to cool bearing lubricating oil on can body making machines. These machines take flat, lithographed bodies and form and lock the side seams. Before installing the Young Coolers, heat generated by friction of the machine caused the lubricating oil to form a varnish, freezing-up the bearings. This resulted in considerable machine down time for cleaning. With the installation of efficient Young Heat Exchangers on all machines in the plant, bearing freeze-ups no longer occur. Young Heat Exchangers are available with fixed or removable tube bundles for fresh or salt water applications. For further details see your Young Representative or write direct.

Young Type "R" two pass removable tube bundle Heat Exchanger.

Young Type "F" single pass fixed tube bundle Heat Exchanger.

APPLICATIONS: Cooling lube oil, cutting fluids, bearing oil, dynamometer test stand, marine lube oil, electronic equipment; hydraulic presses, jacket water, heat reclaiming, and many other uses.

YOUNG RADIATOR CO. RACINE, WIS. Dept. 444-L PLANTS AT: RACINE, WIS. MATTOON, ILL.



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by Elmer F. Heiser

The first book of its kind—written by a practical man for practical men. Based on 18 years of first hand experience in working with plant people on cylinder design, selection and application.

Twenty-one chapters packed with useful information for the man who buys, uses and maintains both hydraulic and pneumatic cylinders.

One chapter—"Cushion Limitations and Variations"—is the most complete practical treatment on cushions ever published. Other chapters are devoted to Ordering Information, Standard and Not-So-Standard Cylinders, Operating Speed, Shock, Mounting Clearances, Air Power-Oil Control.

SERVICE DEPARTMENT

APPLIED HYDRAULICS

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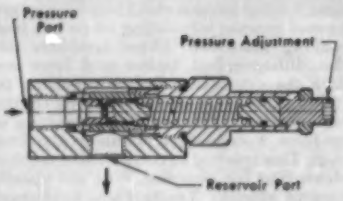
NEW! Relief Valve For Low Pressure 10 To 500 P.S.I. Oil

Designed For Continuous Operation

For systems where pressure is regulated by spilling over the relief valve.

- Long Life—hardened steel parts
- Quiet—no chatter or rumble
- Dependable—will not stick open



Write or phone Mentor, Ohio, Blackburn 5-2625 for complete specifications.

Fluid Controls, inc.

Manufacturers of Hydraulic Valves and Devices

Relief Valves • Check Valves • Restrictor Valves
Needle Valves • Pilot Check Valves • Special Valves
Pressure Compensated Flow Regulators

1284 N. CENTER STREET • MENTOR, OHIO

Post Scripts of Industry

sales techniques, advertising materials, and market analysis discussed during the three day meetings. In connection with a factory tour a new machine was shown for the first time, and the company's new movie "Operation Pushbutton" was given its premiere. H. B. Link, Bellows' president stated this meeting gave the field engineers a better understanding of company operations and help sell the excellent products manufactured.

The West Coast operations of **Quaker Rubber Corporation** and its recent acquisition, Pioneer Rubber Mills, Pittsburg, California, was merged under the name of **Quaker Pioneer Rubber Mills,** Division of H. K. Porter Company, Inc.

Dee Aircraft Supply Co., New Hyde Park, Long Island, N. Y.,

NICHOLSON

VALVES *for Air & Fluid Power*

Solenoid, Motor, Lever, Foot types for every medium

Nicholson furnishes valves for cylinder control, distributing, metering and for many special operating cycles. Installations in a wide range of plants have been in constant service for well over 25 years. In addition to their long wear and minimum maintenance, Nicholson valves feature: specially treated hard seats and lapping flat discs which actually become tighter with use; choice of 6 metal combinations to suit your specific service; positive protection against grit. Sizes, ¼" to 2½". Pressures up to 5000 lbs.

Send for Catalog

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WIGGINS INST-O-MATIC COUPLINGS

QUICK—DISCONNECT

use WIGGINS COUPLINGS for

OIL
AIR
WATER
L P GAS
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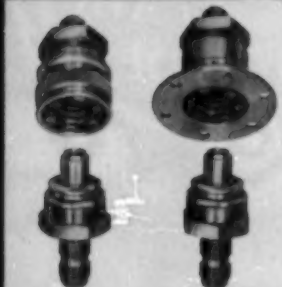
FUEL OIL
DIESEL OIL



Manual Quick Disconnect (Push-Pull Positive Action)

Automatic Quick Disconnect (Breaks Away at Pre-determined Weight Load)

SIZES: ¼" TO 2½

WRITE FOR FURTHER INFORMATION

Wiggins

E. B. WIGGINS OIL TOOL COMPANY, INC.

3424 East Olympic Boulevard, Los Angeles 23, California

Circle 90 on Reader Service Card

Circle 131 on Reader Service Card

headed by **John Dee,** was named a distributor for **Roylyn Incorporated.** The company will stock Roylyn products.

Robert Frost was named advertising manager of **National Pneumatic Co.** and Holtzer-Cabot Divisions, Boston. Frost previously worked with the company as a consultant.

Willard Haas was named technical manager of hose for **The B. F. Goodrich Company,** Industrial Products Division. Haas joined the company in 1929, has been with the hose technical group since 1937.

Willard Haas
The B. F. Goodrich Co.

Christopher Clarkson
Vickers-Armstrongs, Limited

Christopher Clarkson has been appointed representative of **Vickers-Armstrong, Ltd.,** in the United States. Civil Air Attache at the British Embassy in Washington from 1948-1952, he has since then represented various British aviation companies in New York. Clarkson will maintain offices at 10 Rockefeller Plaza, New York City.

Keeps Oils Clean
EVEN WHEN SYSTEMS AREN'T DRAINED FOR A YEAR!
GENERAL AF-500
Industrial FILTERS
Keeping hydraulic and lubricating oils free from impurities can be a costly process — one demanding the frequent draining and refilling of entire oil systems. But with the GENERAL AF-500's positive absorption . . . moisture, dirt, rust, tars and lint are safely trapped in the finest wool felt, assuring trouble-free, uninterrupted operation of oil systems for as long as a year! Machine parts are protected from abrasive wear and maintenance costs are reduced on both new and old equipment.
No other Filter like it!
TWO-FOLD ELEMENT
The AF-500 actually works two ways — its ALL-WOOL felt element traps moisture and dirt particles as fine as 5 microns.
CLEAN, SAFE LIQUIDS
Clean, completely dependable oils, paints, lacquers and other industrial liquids are assured at 15-20 gpm, depending on viscosity.
LONGER MACHINE LIFE
Both on new and old equipment, GENERALS protect vital machine parts from abrasive wear, greatly prolonging service life.
SIMPLE DISASSEMBLY
Cleanable wool felt cartridge can be quickly removed and washed in any suitable solvent without disturbing inlet or outlet lines. Merely unscrew center bolt, lift off cover and two washers, and remove felt cartridge intact.
WRITE us — without obligation — about your industrial filtering problems.
GENERAL FILTERS, INC.
43800 GRAND RIVER AVENUE • NOVI, MICHIGAN
CANADIAN GENERAL FILTERS, LTD., 2679 DANFORTH AVENUE
TORONTO 13, ONTARIO

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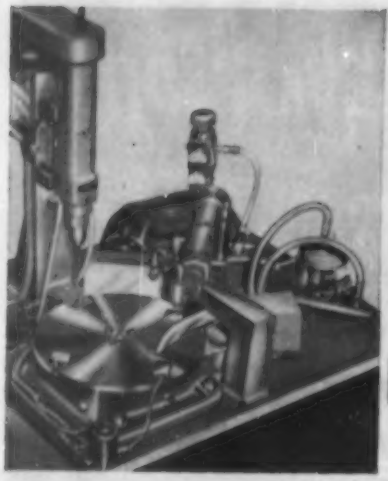

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INDEXING
DIAL FEED TABLES
WITH
POSITIVE LOCK FEATURE

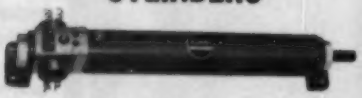
ALSO AVAILABLE:
ALLENAIR VALVES & CLAMPS

ILLUSTRATED CATALOGS SENT ON REQUEST

The A. K. ALLEN CO.
57 MESEROLE AVENUE
BROOKLYN 22, NEW YORK

AGENTS IN PRINCIPAL CITIES

CYLINDERS



Plain or with Built-in Valves.
Up to 2" of stroke in stock.

Post Scripts of Industry

The Garlock Packing Company, Palmyra, New York, announced the appointment of **J. B. Sewell** as general sales manager. He will direct the sales of Garlock products through the company's 29 divisional offices. Starting in 1935 as salesman for the Montreal, Canada, area, Sewell became vice president of the Garlock Packing Company of Canada, Ltd., in 1947.

J. B. Sewell
The Garlock Packing Company

A. B. Quinn
Stratoflex, Inc.

Construction and opening of a factory branch of **Stratoflex, Inc.** in Los Angeles, California was announced. Located at 9430 Bellanca Avenue, this branch was set up to serve the West Coast, Alaska and Hawaii. The operation is headed by district manager **A. B. Quinn. W. L. Jones** is branch manager, **C. L. Parker** plant foreman.

★ONLY THREE PARTS
★MEETS J.I.C. STANDARDS
★GREATER FILTERING AREA
★SPECIAL TRAP-WEAVE MESH

The New
CAPITAL HYDRAULIC OIL FILTER
WITH MONEL METAL INSERT

Reservoir Type for Hydraulic and Oil Re-Circulating Machinery

EASY TO INSTALL • EASY TO CLEAN • LONG LIFE • LOW COST

SIZES AND SCREENS TO FIT YOUR NEEDS.

CAPITAL ENGINEERING & MFG. CORP.
5837 South Ashland Avenue Chicago 36, Illinois

Circle 23 on Reader Service Card

Aeroquip Corporation appointed **Forrest F. Hinkley** as general manager of Aero-Coupling Corporation, Burbank, California, Aeroquip subsidiary. An Aeroquip executive for the past eleven years, Hinkley was formerly director of subsidiary operations at the company's Jackson plant. He will now be responsible for all sales and manufacturing functions of the West Coast operation.

Forrest F. Hinkley
Aeroquip Corporation

Robert H. Davies
The Parker Appliance Co.

Robert H. Davies was appointed vice president in charge of engineering for **The Parker Appliance Company** and its subsidiaries. Engineering manager of the company since 1946, Davies has been responsible for supervising the design and development of most of Parker's expanded product lines in the hydraulic and fluid system field.

UNDEFEATED!

AND

STILL CHAMPION

CAN YOU SUPPLY A CHALLENGER?

. . . That difficult fluid, gas, or air transmission problem in your plant—We'll send you a Snap-tite Hi-Flow quick connect disconnect coupling with or without automatic shut-off in any size 1/8" to 3"—Test it in your plant, under actual working conditions—You be the judge—If it doesn't solve your problem or do a better job than the coupling you are now using, ship it back collect—Write today on your letterhead, briefly outlining your problem—We'll ship immediately.

Snap-tite INC.

201 S. Rockwood, Union City, Penna.

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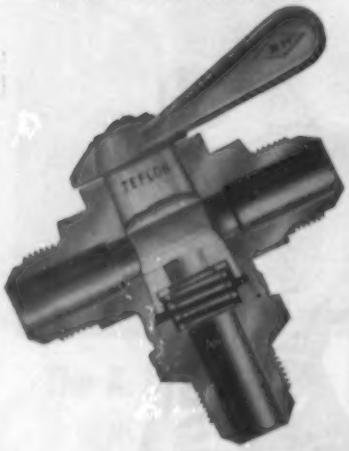
NEW! REPUBLIC SELECTOR VALVES NEW!

"LO-TEMP"
−65° without lubricant

"LO-TORQ"
6000 psi service



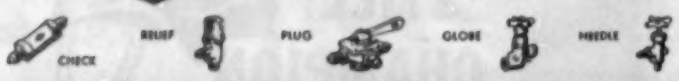
LO-TORQ SELECTOR

BALANCED PRESSURE
FOR EASY TURNING

With service pressure and seals on both sides of valving disk, turning is easy. Design is simple—maintenance is low. Many services—Air, and gas 4000 psi; fuel, hydraulic oil, petroleum, water, 6000 psi. Made in bronze, semi-steel, aluminum alloy, in three different portings, ⅛" to 1". Request Bulletin No. 454.

LO-TEMP SELECTOR

Teflon plug ends the need for lubricant. Easy turning—non seizing. −65° to 250°F. 2- 3- 4-way. 100 psi service. Made in aluminum alloy or stainless steel. ⅛" to 1" pipe or tube. Request Bulletin No. 754.



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RM

REPUBLIC MANUFACTURING CO.

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NEW MARSH Serviceman Soundscope

. . . cuts servicing and maintenance costs

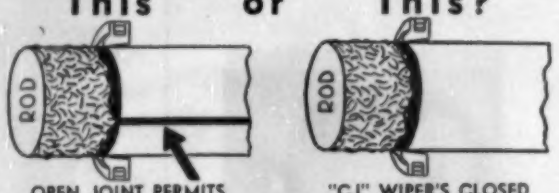
Most effective instrument ever developed for pin-pointing and identifying mechanical defects. Saves time and dollars tracking down troubles in bearings, gears, mechanisms . . . detects leaks, knocks, piston slaps—any defects that make a sound. A precision instrument of Marsh quality, sensitive to faintest sounds . . . with handy probe and headband as illustrated. A remarkable tool, moderately priced.

Ask for Circular

MARSH INSTRUMENT CO.
Sales affiliate of Jos. P. Marsh Corporation
Dept. 19, Skokie, Illinois

For Industrial Use—

This or This?



OPEN JOINT PERMITS A STREAK OF DIRT AT JOINT OPENING

"CJ" WIPER'S CLOSED JOINT KEEPS THE ENTIRE ROD CLEAN

For those dry operations requiring absolute freedom from dust or dirt passing through joint of ring to bearings or packings, we have especially designed—the

FALL WIPER RING with Closed Joint

(our P/N-FWR-CJ)

In addition to the above, and since 1944, we have also manufactured **For Army and Navy Use the 3 Piece FALL WIPER RING FWR-3C**

Spec. MIL-S-5049, AN Approved, Military part numbers from AN6231A1, ½", to AN6231A71, 15" diameter. This ring consists of 3 pieces assembled into one . . (1) a one-piece Split Wiper Ring (Body) with 2 flanges or groove in its O.D.; (2) a one-piece split compressor spring assembled in groove (3) and endless cover band surrounding spring in groove which causes squeeze grip action on piston rod.

Squeeze Grip Action Does It—patented

—and squeeze grip is always the same because uniform tension of spring under endless cover band. Rods or pistons do not stick or become immobile in ANY temperature.

Our engineers will gladly work with you on any wiper ring problem. Write, wire or phone us.

Ace Products Co., Toledo 1, Ohio

Phone Adams 6513

Fall Viper Ring SPRING LOADED

Covered by patents issued and patents pending.

Circle 82 on Reader Service Card

Circle 1 on Reader Service Card

Racine Hydraulics and Machinery, Inc., entertained its distributors from all parts of the United States and Canada, on August 25-27. Nearly 60 representatives attended the technical conference which included discussions on technical aspects of the company's products, new designs, production methods, new equipment and manufacturing standards. Also outlined were sales promotion plans, general advertising and the setting up of speakers' panels that will appear before engineering groups and societies.

Le Roi Company's president T. O. Liebscher announced the following appointments: **Jack E. Heuser** to vice president in charge of sales, he will be responsible for a newly created sales division which will sell and service all products manufactured by the company. **Ray H. Rodolf,** from sales manager, construction and mining division, to general manager, compressor division; and **Herschel V. Hiatt** to general manager, engine division.

THE MARKET PLACE

Classified ad rates: "Position Wanted"—$8.00 minimum, limit 25 words. All other classified $10.00 minimum for 25 words or less, each additional word $.30. Bold face type or capitals—$12.00 minimum for 25 words or less, each additional word $.35.

WANTED—SURPLUS ROD & BAR

Stainless—Aluminum—Steel—Brass
Any size; type and quantity. Cash for termination inventories.

Send lists to:

Collins Engineering Company
9050 Washington Blvd., Culver City, Calif.

WANTED
SURPLUS AIRCRAFT PARTS

or termination inventories
Get our cash offer by return mail.

Send lists to:

Collins Engineering Company
9050 Washington Blvd., Culver City, Calif.

Big one: Anker-Holth Rotating Hydraulic Cylinder with 21" bore and 20" stroke, for 3000 psi. Little one: Anker-Holth Air Cylinder with 3" bore, 3" stroke.

Anker-Holth has the answer!

• Your problem in power motion may be far removed from the Anker-Holth Cylinders shown above. Whatever your need for air or hydraulic cylinder power, Anker-Holth has the engineering know-how and manufacturing facilities to match your specific requirement. Anker-Holth engineers will gladly assist you. Call or write Anker-Holth Division of The Wellman Engineering Company, Dept. C-17, 2723 Conner Street, Port Huron, Michigan.

FREE on request... bulletin on complete line of Anker-Holth products.

Anker-Holth
ENGINEERED CYLINDER POWER
WELLMAN

Division of THE WELLMAN ENGINEERING COMPANY

Circle 63 on Reader Service Card

Backed by more than a century's experience, members of the Hydraulic Association offer complete units, components and systems for every purpose. Designed by experts, built by craftsmen using the finest materials, these products uphold the British tradition of quality.

The HYDRAULIC ASSOCIATION of Great Britain

94/98 Petty France,
London, S.W.1
England

Telephone: Abbey 1845
Cables: Crusado, Sowest, London

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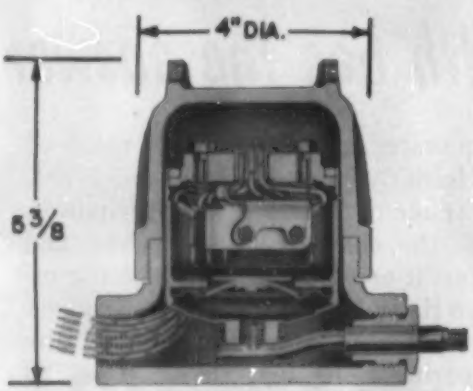
PRESSURE & VACUUM SWITCHES

FOR

Explosion-Proof

SERVICE



The most compact units in their service range, with the same unmatched repeat accuracy that distinguishes the entire line of Meletron pressure actuated switches. Bulletins 920-25 give detailed characteristics.

BARKSDALE VALVES

5125 Alcoa Avenue Los Angeles 58, Calif.

Circle 24 on Reader Service Card

PROTECT YOUR HYDRAULIC SEALS with the IMPROVED Seal-Guard® METALLIC ROD-WIPERS

Here is a BETTER WAY to insure long life for cylinder rod packings, bearings, machine spindles, guide pins.

Seal-Guard's flexible bronze, knife-edge wiping rings mould themselves to the shaft contour . . . peel off dirt and grime . . . lift it entirely away from the shaft—no packing or crowding under.

- No chance of fouled bearings or packing.
- Can't damage shaft surfaces.
- Seal-Guards are available to fit rod diameters from ½ to 10 inches. Other sizes by special order.

Write for descriptive literature.

HYDRAULIC ACCESSORIES CO.
24301 Hoover Rd. Van Dyke, Mich.

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Enter Now 1955 APPLIED HYDRAULICS MAGAZINE Prize Paper Contest

$1200 IN CASH AWARDS

You can win one of the cash awards being offered in the 3rd annual APPLIED HYDRAULICS Magazine Prize Paper Contest. Anyone who uses, designs, builds or maintains pneumatic or hydraulic machines or equipment can enter this contest.

HERE'S WHAT YOU CAN WIN:

1st PRIZE	2nd PRIZE	3rd PRIZE	4th through 7th
$500	$300	$200	Prizes $50

. . . and all other papers judged as meriting publication will be paid for and published in APPLIED HYDRAULICS.

WHAT KIND OF ARTICLE?

Your copies of APPLIED HYDRAULICS are the best guide for the type of article and presentation. To learn what the judges in 1953 and 1954 considered as prize winners, take a look at the October 1953 and October 1954 issues.

HOW DO YOU ENTER?

Write to the APPLIED HYDRAULICS Prize Paper Contest Editor for an entry blank. We'll send you a blank and suggestions to help prepare your article. To win a cash award, your article must be mailed by June 1st, 1955.

Write today for your entry blank—APPLIED HYDRAULICS, 1240 Ontario, Cleveland 13, Ohio

HOW HYDRO-WYPES
take the AGGRAVATION out of AUTOMATION

(AN 6231-A)

PROBLEM # 4 —

A large manufacturer of accounting machines was replacing O ring packings on an average of one every other day in a number of air chucks used in automatic drilling operations. Fine chips dropped around the collet, scoring the O ring, causing air leakage and, eventually, a work stoppage. Downtime and maintenance was excessive.

SOLUTION —

A Hydro-Wype Scraper Ring A21 was installed in one of the chucks. Within ten days additional Hydro-Wype A21's were ordered for all of the equipment in operation.

RESULTS —

Since the first installation of the Hydro-Wype "A" Scraper Ring, not one minute has been lost in "down time"; not a single air chuck has required repair.

LOOK FOR THIS DECAL ON EQUIPMENT YOU BUY

EQUIPPED FOR LONGER LIFE with HYDRO WYPE SCRAPER RINGS

YOU CAN TELL THE QUALITY OF A PRODUCT BY THE COMPANY IT KEEPS

For an immediate solution to your problems, contact your nearest representative . . .

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Pelham Manor 65, New York

Eastern Pennsylvania, Delaware
J. Neill Armstrong
426 Addison Avenue
Westmont, New Jersey

Colorado, New Mexico, Utah, Wyoming, Idaho, Alaska
Fred A. Pease
P. O. Box 1566 Stapleton Airfield
Denver, Colorado

Kansas
Claude Mann & Associates
237 South Hydraulic Street
Wichita 7, Kansas

Eastern Wisconsin
Machell Rubber & Supply Co.
1730 North 12th Street
Milwaukee 5, Wisconsin

Northern California
Haskel Engineering & Supply Co.
1245 22nd Street
San Francisco 7, California

Minnesota, Montana, South Dakota, North Dakota, Western Wisconsin
W. F. Aske & Son
5407 Excelsior Blvd.
Minneapolis, Minnesota

Arizona
Wheel Industries
2600 South Santa Fe Avenue
Los Angeles 58, California

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Haskel Seals
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Glendale 4, California

Southern Ohio, Kentucky
J. A. Lombard Co.
P. O. Box 481
Dayton 2, Ohio

Western New York
H. D. McRae
70 Queens Street
Rochester 9, New York

Nevada, Hawaii
Wheel Industries
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San Francisco, California

Southern Indiana
Wellman Engineering Co.
4618 Winthrop Avenue
Indianapolis 5, Indiana

Dallas
Stanco Co.
1914 Canton St.
Dallas, Texas

Bill Coleman Assoc.
P. O. Box 6028
Dallas 1, Texas

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Barton Sales Co.
1609 West Third Street
Ft. Wayne 7, Indiana

Michigan
F. B. Wright Co.
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Detroit 6, Michigan

Northern Ohio
Elmer W. Pfeil, Inc.
624 Engineers Blvd.
Cleveland 14, Ohio

Maryland, Virginia
Howell-Lanier Co.
4703 Ritchie Highway
Baltimore 25, Maryland

Western Pennsylvania
Elmer W. Pfeil, Inc.
610 Smithfield St.
Pittsburgh 2, Pa.

Ontario & Quebec, Canada
Higginson Engr. Sales Co.
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Hamilton, Ontario, Canada

Oklahoma, Nebraska, Western Iowa & Western Missouri
Ellis Akin Engineering Co.
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Kansas City, Missouri

Illinois, Eastern Iowa
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Chicago 24, Ill.

. . . or write to

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1926 East Siebenthaler Ave.
Dayton 4, Ohio

Nation widu sales & service representatives for

Gadgets, inc.

★ Hydro-Wypes available 5/16" to 30" Dia.
★ Hydro-Wype Adapters available for quick, easy installation on existing equipment.
★ Approved Specification MIL-S-5049.

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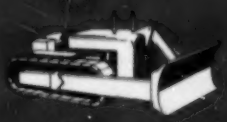
BEFORE YOU DECIDE ON ANY HYDRAULIC PUMP FOR YOUR PRODUCT LOOK OVER THESE

CHECK POINTS OF Pesco SUPERIORITY



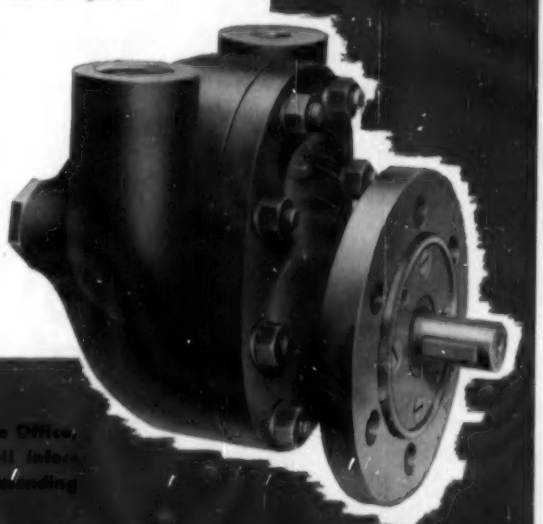
DEPENDABLE PERFORMANCE—Thousands of PESCO Pressure Loaded PUMPS on critical installations, have proved their dependability of operation with exceptional high-efficiency performance of their specific jobs.

CONTINUOUS "NEW PUMP" EFFICIENCY—PESCO quality control, from original design through precision manufacture and final testing, builds into PESCO products every characteristic that will insure life-long, peak-operating efficiency and "new pump" performance—with volumetric efficiencies to 97% and torque efficiencies to 92%.

FULL RANGE OF CAPACITIES AND PRESSURES—PESCO PUMPS provide a full range of capacities to 60 gpm and pressures to 3000 psi. Operating speeds range from 1000 rpm to 4500.

HYDRAULIC ENGINEERING SERVICE—This outstanding PESCO service is available for solution of hydraulic problems. Simply call or write the Home Office, Bedford, Ohio—The combined experience and skill of Pesco Hydraulic engineers is yours without obligation.

LESS UNIT SPACE REQUIRED—The "Pressure Loading" features of PESCO PUMPS reduce the overall size requirement for a given installation. This is possible because PESCO PUMPS can be operated safely at higher speeds—and still maintain the same excellent volumetric efficiencies at slow operating speeds.



Call or write the Home Office, Bedford, Ohio for full information on these outstanding PESCO PRODUCTS.

HYDRAULIC PUMPS • HYDRAULIC MOTORS • CONTROLS AND VALVES POWER PACKAGES • ELECTRIC MOTORS

engineering Pesco production PRODUCTS DIVISION

PRODUCING THE BEST IN HYDRAULIC EQUIPMENT AND ELECTRIC MOTORS

BORG-WARNER CORPORATION

24700 NORTH MILES ROAD • BEDFORD, OHIO

Circle 98 on Reader Service Card

Announcing

JANUARY, 1955 ISSUE

APPLIED HYDRAULICS 5th Annual Directory and Buyers Guide

The one and only complete buying reference in the fluid power field.

CONTENTS:

1 Complete alphabetical directory of manufacturers and products that they make. (Advertisers listed in bold face type.)

2 The only complete products directory of the fluid power field with list of manufacturers and their addresses. (Advertisers listed in bold face type.)

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